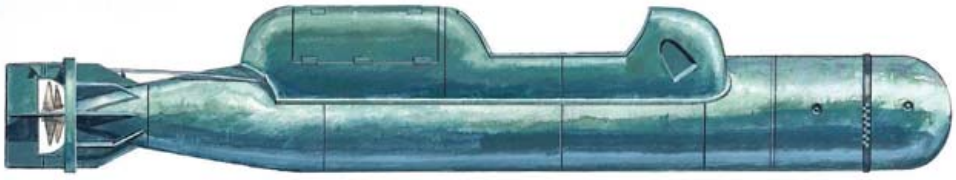
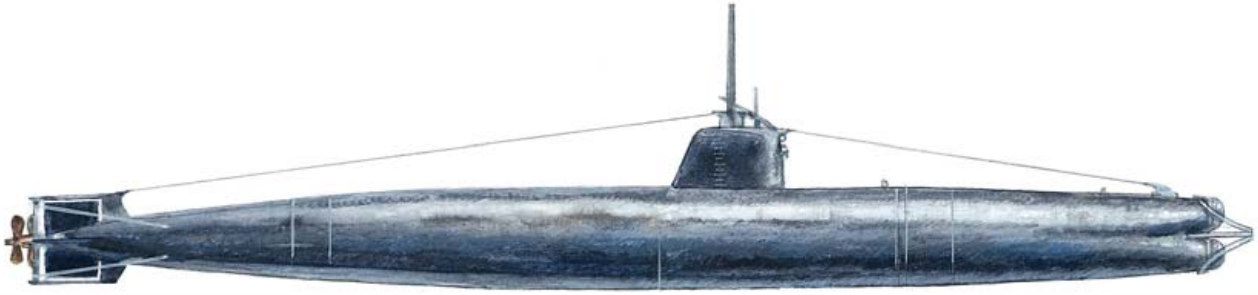
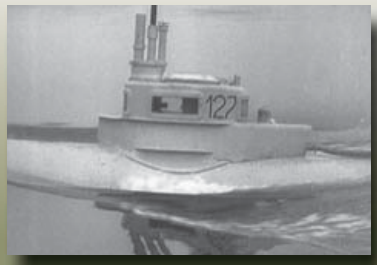
AXIS MIDGET SUBMARINES

1939–45







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NEW VANGUARD 212

AXIS MIDGET SUBMARINES

JAMIE PRENATT & MARK STILLE

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AXIS MIDGET SUBMARINES

INTRODUCTION

Overshadowed by the U-boat war in the North Atlantic, the story of Axis midget craft – manned torpedoes and midget submarines – has received little attention outside specialist naval circles. Most surprising is the sheer number of vessels built: Italy, Germany, and Japan constructed approximately 2,000. Of these, only the five Japanese midget submarines that took part in the attack on Pearl Harbor are relatively well known. Although their mission was a failure, the nine crewmen who did not survive were elevated to the status of "war gods" by the Japanese, much to the consternation of the naval aviators responsible for the vast majority of the attack.

As at Pearl Harbor, many Axis midget craft attacks were unsuccessful. Although not intended to be suicide craft, the survival rate of these vessels and their brave crews – at least in the beginning – was appallingly low. While provision was made to recover them after their missions, frequently the best the crews could hope for was captivity in a prisoner-of-war camp.

Italy had some spectacular successes in the Mediterranean Sea. Ultimately, however, these and other more minor contributions by Axis midget craft did not make a decisive contribution to the war. Midget craft still have a role today as an important tool for special operations forces, research vessels, cargo transports for narco-traffickers, and playthings for the ultra-wealthy.

ORIGINS

Midget craft were originally developed by the militarily weaker powers. The first was David Bushnell's submersible *Turtle,* built and used in combat during the American War of Independence. During the 1800s, a number of ideas were formulated in Europe, but the most fruitful activity took place in the United States. The American Civil War served as the catalyst for several designs. Most notable was the Confederacy's CSS *Hunley*, used to sink the Federal sloop-of-war USS *Housatonic* in the first successful attack by a submarine. These early craft were extremely crude, but by the late 1890s John Holland had developed a practical small submarine that he later sold to the US Navy. Although submarines became progressively larger and more capable, small submarines remained in service and saw action in World War I. That war also saw the first employment of a manned torpedo, the Italian *Mignatta*.

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ITALY

History and Doctrine

Italy's development of manned torpedoes and midget submarines benefited conceptually, technically, and doctrinally from its experience in World War I. Italy fielded both midget submarines and a manned torpedo during that conflict, and successfully carried out operations including the penetration of a defended anchorage and the sinking of a large warship.

Interest in these types of vessels received impetus from Italy's inferior naval position in capital ships resulting from the 1922 Washington Naval Treaty, tensions with Britain arising from the war in Abyssinia, and the fact that they could be produced quickly, cheaply, and in secret. In addition, they were well suited to attacking British and French vessels, Italy's most likely naval adversaries, which were limited to a small number of bases in the Mediterranean. Use of manned torpedoes, particularly in surprise attacks against enemy vessels in port, would provide Italy an opportunity potentially to change the naval balance of power in the Mediterranean. In addition, with its long coastline, Italy had a pressing need for coastal patrol and harbor defense, a role that midget submarines were well adapted to fill.

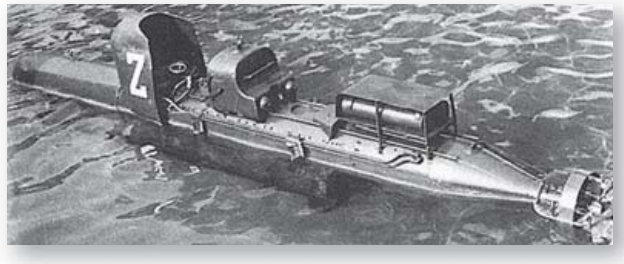
Manned Torpedo Development

SLC (Siluro a Lenta Corsa)

SLC/SSB SPECIFICATIONS	
Units in class	42 (possibly 50)/three
Length	7.3m /6.77m
Beam	0.533m/0.79m
Machinery	one 1.6hp electric motor/one 7.5hp electric motor
Armament	one 230kg or two 125kg mines/one 300kg or one 400kg or two 180/200kg mines
Crew	two

The progenitor of the Siluro a Lenta Corsa or Slow Speed Torpedo, also known as the "maiale" or "pig," was the Italian *Mignatta*, developed in 1918. Designed to attack vessels at anchor, the torpedo-like device carried two divers and magnetic mines. Due to its short range it was transported to its operational area by a surface vessel. It was used to sink the recently constructed Austro-Hungarian battleship SMS *Viribus Unitis* in Pola harbor in November 1918.

In 1935, two naval engineer officers, Teseo Tesei and Elios Toschi, developed a concept – based on an idea formulated by Tesei in 1927 – for what would become the SLC and proposed it to the Naval Ministry. They received the authority to develop two prototypes and limited resources at the La Spezia naval arsenal. Based on experience with the first prototype, in early 1936 the second prototype was modified, four additional prototypes were ordered, and training of the initial cadre of operators began. Although the project was halted in August after the end of the war in Abyssinia, the Office of Plans and Operations restarted it in 1937 and another five SLCs were built. In



Although in many ways primitive and mechanically temperamental, when carefully maintained the SLC gave good service. Stirrups that held the operators' legs while the craft was in motion are in their folded position against the side. Centrally located is the crash dive tank with a short vent on top and two compressed air cylinders that allowed it to be emptied. (On-hand photo)

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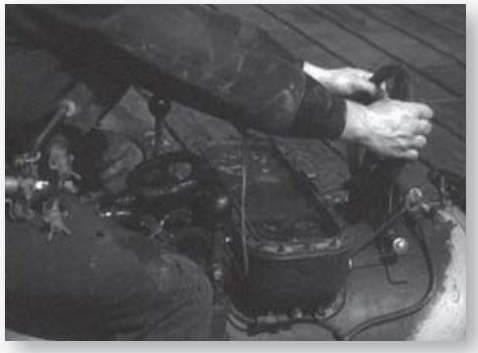
The SLC warheads were attached to the craft using metal bands that could be released easily and quickly. On the side of the warhead is the recess for the time-delay fuse. (NARA)



The SLC's controls. The pilot's hands are shown on a wheel that could be turned and tilted forward and backward to control the rudder and hydroplanes. By his knees are the levers controlling the tank pumps and between them a wheel for speed control. (NARA)

July 1940, eight improved "100-series" SLCs were ordered, followed in 1941 by "200-series" machines that incorporated training and operational lessons learned.

The standard 533mm torpedo, which served as the basis for the SLC, was heavily modified. The propulsion unit and contra-rotating propellers were replaced by an electric motor and a larger-diameter single propeller that produced less noise, being better suited to slow speeds. An oversized rudder and hydroplanes were also fitted. A detachable 230kg warhead (later replaced by two 125kg warheads for use against unarmored merchant vessels) with a mechanical time fuse was attached to the front. The warhead had very slight negative buoyancy and could be easily manipulated under water.

Two operators – an officer who piloted the craft and an NCO or enlisted diver who performed all other functions – rode the SLC, which was fitted with stirrups to support their legs. A shield-like breakwater protected the pilot. The pilot had an instrument cluster containing a depth gauge, compass, a battery voltmeter, two ammeters, trim tank pressure gauge, and a bubble level. A tilting wheel controlled the rudder and hydroplanes and there was a four-position speed control. Levers controlled the filling and emptying of the trim tanks. Between the operators was a fast diving tank, controlled by a lever on the side, which allowed the SLC to submerge in 6–7 seconds, and two associated compressed air cylinders. A box behind the second seat contained net lifters, net cutters, clamps, rope, spare breathing equipment, and a long length of cord attached to a block of wood to enable the diver to find his way back to the SLC.

The SLC had a simple instrument cluster. A bubble level separated the large depth gauge and compass. To the right one can identify an ammeter and voltmeter. (NARA)

The SLC had a reputation for being mechanically unreliable, and its short range usually required it to be transported to the target area. The original intent of delivering them by air was abandoned due to technical problems, a lack of inter-service cooperation with the Air Force, and the fact that there was no naval air arm. Use of a Cant Z.506 seaplane to carry a single SLC was studied in 1940 but rejected for technical reasons. In mid-1943, the Tenth Flotilla evaluated the possibility of using a Cant Z.511 four-engine seaplane to carry an MTSM torpedo boat and two SLCs or, alternatively, a single SLC and seven combat swimmers for an attack on the port of New York City. The Cant Z.511 would

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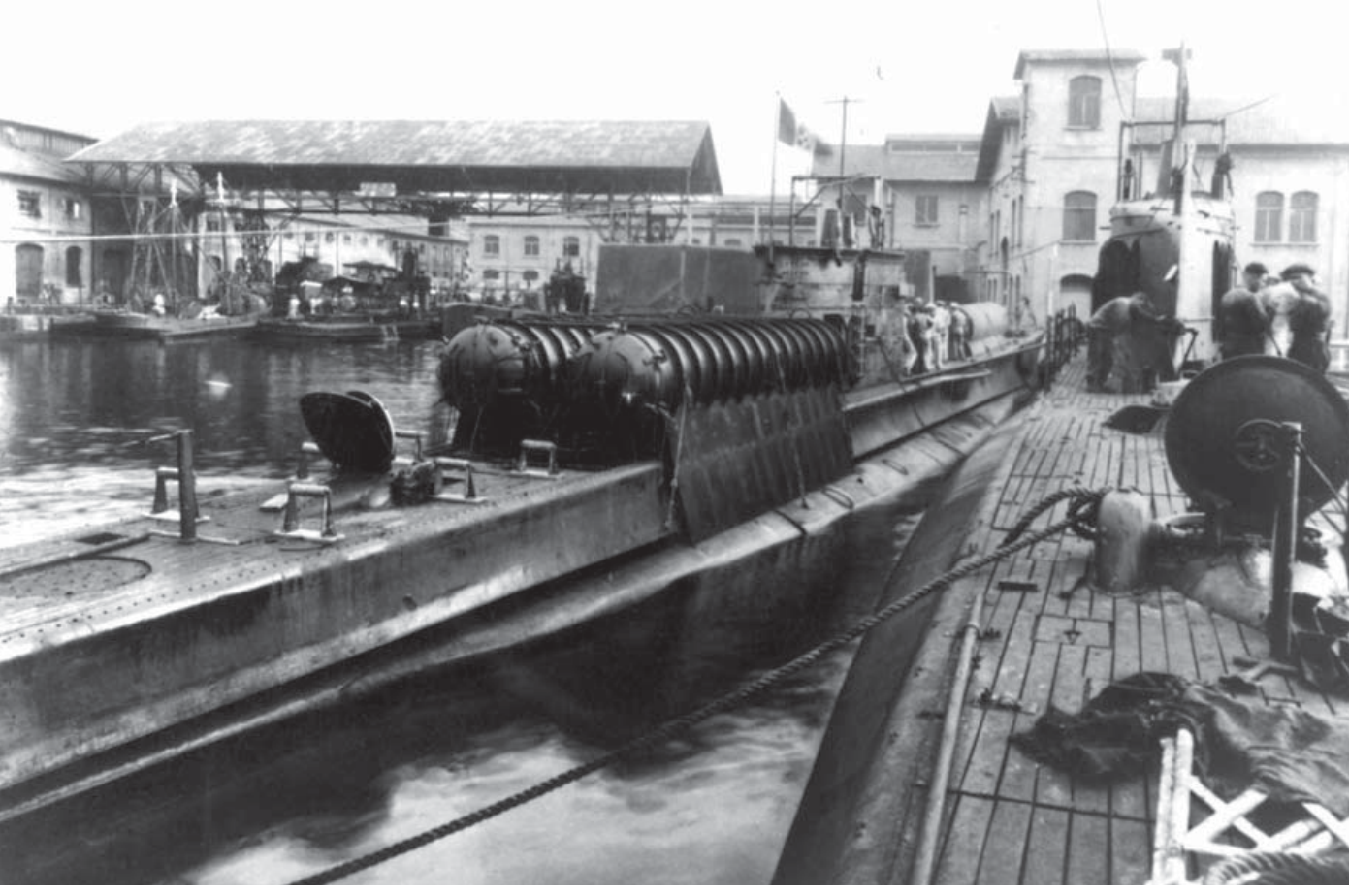

Gondar belonged to the same class and series as the *Scirè* and also had three pressure cylinders for transporting SLCs fitted on the deck, one forward and two aft. It can be distinguished from the otherwise identical *Scirè* by the smooth surface of the forward pressure cylinder. The forward pressure cylinder on the *Scirè* had the same ribbed surface as the ones aft. (Historical Archives, Italian Navy)

approach the US coast and release the MTSM and SLC(s). The MTSM would, in turn, deliver the SLC(s) and any combat swimmers to the immediate vicinity of the port, where they could execute their mission.

Training to deliver SLCs to their operational area by large conventional submarine began in 1940, with three SLCs fastened on the submarine *Ametista*'s deck. A radio beaconing system to guide the operators back to the submarine at the conclusion of a mission was tested but found unsatisfactory. In order not to restrict the submarine's depth while carrying SLCs, as was the case with the first transport *Iride*, three submarines – *Scirè*, *Gondar*, and *Ambra* – were each fitted with three watertight pressure cylinders capable of accommodating an SLC. The submarines *Grongo* and *Murena* were each fitted with four pressure cylinders. The SLC operators would exit the submerged submarine through a lockout chamber, open the pressure cylinders, remove and trim their SLCs, and proceed with their mission.

SLCs could also be transported, launched, and recovered by the MTL (Motoscafo Turismo Lento), an 8.5m-long powerboat. Six MTLs, each capable of carrying two SLCs, were built. Two 28m motor torpedo boats, MS 74 and MS 75, were also modified to transport and launch two SLCs each but lacked the ability to recover them.

SSB (Siluro San Bartolomeo)

The SSB (St Bartholomew Torpedo) was developed to address the shortcomings of the SLC. It had the same general configuration as the SLC, but a much larger diameter and the operators sat in, rather than on, the craft. This protected them better while surfaced and from the water pressure generated by the SSB's higher speed (4kt in comparison to the SLC's 2.5kt)

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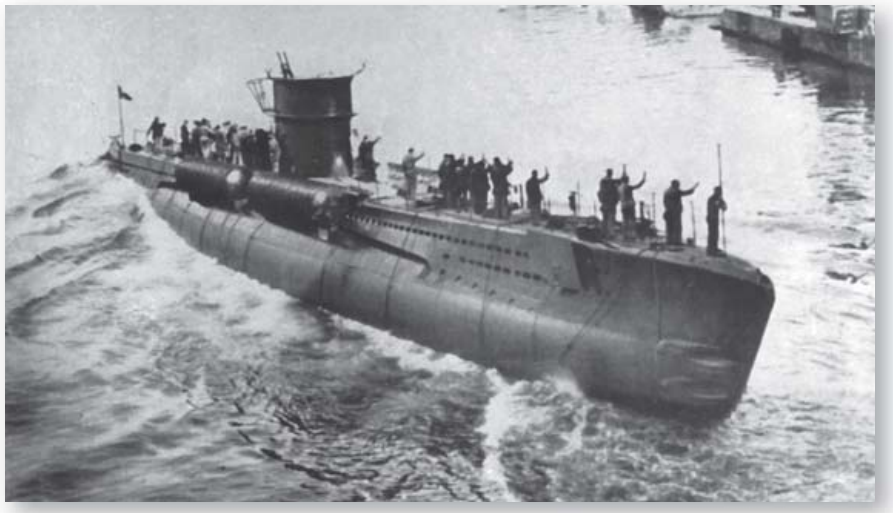


Two other boats, the Flutto-class submarines *Murena* and *Grongo*, were also able to carry SLCs and other assault craft. Their four pressure cylinders were mounted in twos on each side of the boat. The *Murena* is shown here during her launching. (Historical Archives, Italian Navy)

while submerged. The SSB also had a larger battery capacity, two counter-rotating three-bladed propellers, and two small retractable horizontal stabilizing fins at the front of the top fairing. The SSB was not only far superior to the SLC in terms of speed, range, maneuverability, and payload, but also more reliable. Three SSBs were built prior to the armistice, but were too late to see service.

Manned Torpedo Wartime Service

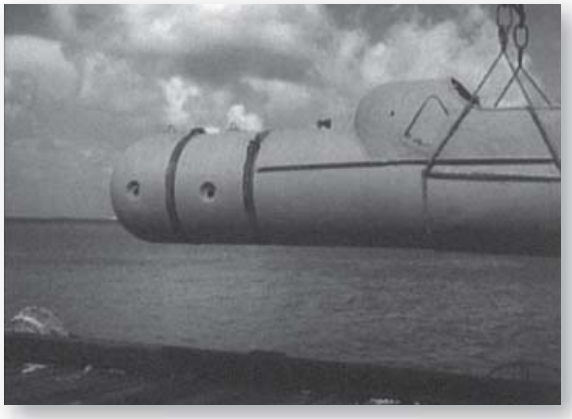
Operation *G.A. 1* – Attack on Alexandria

The first SLC attack was to be on the night of August 25/26, 1940. The intended targets were two battleships and an aircraft carrier in Alexandria harbor. The submarine *Iride* left Italy for the Gulf of Bomba where four SLCs and their crews were transferred from another vessel. Shortly after the transfer, *Iride* and several accompanying vessels came under attack from three British Swordfish aircraft. Unable to dive due to the shallow (15m-deep) water, *Iride* exchanged fire with the aircraft, taking casualties before one aircraft fired a torpedo that struck the submarine. *Iride* sank immediately.

Operation *G.A. 2* – Attack on Alexandria

Three SLCs carried by *Gondar* were to carry out the attack aborted by the loss of *Iride*. After reaching the coast off Alexandria, *Gondar* was ordered back to the Gulf of Bomba when reconnaissance reported that the harbor was empty. The *Gondar*, running on the surface, came under attack from two destroyers, a corvette, and later a Sunderland flying boat. On September 30, under attack for more than 12 hours and badly damaged, *Gondar* surfaced and was scuttled by her crew.

The SSB was larger and more capable than the SLC in every respect. The one here has the two warheads for use against merchant vessels. The outline of the two stabilizing fins, shown here folded, can be seen just forward of the operators' position. (NARA)



Operations *B.G. 1*, *B.G. 2*, and *B.G. 3* – Attacks on Gibraltar

Operation *B.G. 1*, intended to be simultaneous with Operation *G.A. 2*, employed three SLCs carried by *Scirè*. Delivered to the Bay of Algeciras, the three SLC crews were to attack any large ships and return to Italy through occupied Spain. When

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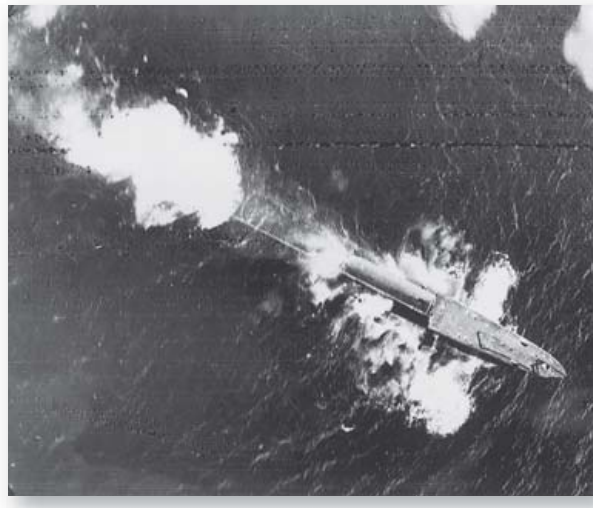
50 miles off Gibraltar, *Scirè* was ordered to abort the attack when it was discovered the harbor was unoccupied.

The attempt was repeated in October as Operation *B.G. 2*. *Scirè* successfully penetrated the Bay of Algeciras and the three SLCs left the submarine. One, traveling on the surface due to a failed compass, was detected by patrol boat. Submerging to 15m, it was attacked and, after the motor stopped, sank. The two operators swam the two miles to Spain and from there returned to Italy. The second SLC crew had problems with both their primary and reserve breathing apparatus, and their SLC developed trim problems due to a malfunctioning trim pump. They abandoned the SLC, aborted the mission, and made their way to Spain and then Italy. The SLC beached itself, was recovered by the Spaniards, and described in the public media. The third SLC also had a failed trim pump, but managed to clear two sets of harbor defense obstructions. Seventy meters from the battleship HMS *Barham*, the SLC's motor stopped. It sank and the SLC pilot's attempt to drag it along the bottom toward the target failed. The pilot abandoned it and both operators were captured.



The final moments of *Gondar* as seen from a British Sunderland flying boat. Attacked while returning from an aborted mission to transport SLCs to Alexandria and badly damaged, it was forced to surface and scuttled by her crew to prevent capture. (IWM CM101)

Operation *B.G. 3*, in May 1941, was similar to the previous two operations. The SLCs were tested more thoroughly and *Scirè* picked up the operators in Cadiz rather than subjecting them to the long voyage from Italy aboard the submarine. As suitable targets were lacking, merchant vessels in the roadstead were to be attacked instead. A series of equipment failures resulted in the loss of all three SLCs, but all the operators eventually reached Italy.

Attack on Malta

Malta was envisioned as one of the targets when development of the SLC was proposed in 1935. Although Malta had been supplanted by Alexandria and Gibraltar as a naval base, forcing entrance to the harbor of La Valletta was believed to have considerable symbolic value. The plan for the July 1941 attack was a very complex one involving two SLCs, a small fleet of explosive boats, multiple objectives, and cooperation from the Italian Air Force. Malta was also heavily defended. The targets of the SLCs were the harbor defense barrier and a group of British submarines.

The attack began behind schedule and was a catastrophic failure. Detected by radar, the attackers came under fire and suffered heavy casualties. The SLC assigned to attack the submarines had motor trouble and was unable to complete its mission; both operators were captured. The warhead of the other SLC detonated, apparently in a suicidal attempt by the pilot, Teseo Tesei, to complete his mission on time. Both operators were killed and the detonation failed to clear the approach to the harbor.

Operation *B.G. 4* – Attack on Gibraltar

The first successful SLC attack, Operation *B.G. 4*, followed the same general plan as the earlier *B.G. 3*. On September 20/21, *Scirè* delivered three SLCs into the Bay of Algeciras. Due to very active British patrolling, all three SLC crews chose to attack merchant shipping in the roadstead. One crew attached their warhead to the 2,444-ton tanker *Fiona Shell,* which split in two and

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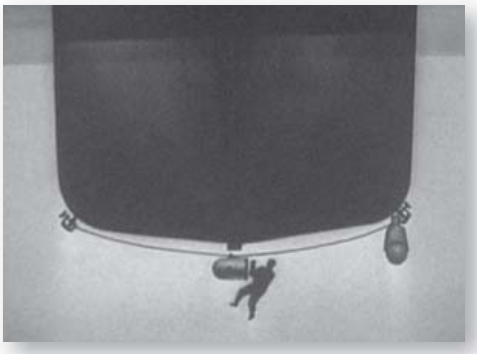

This diagram shows the normal method for employing the SLC's warhead. First, the SLC's second operator would sling a rope from clamps he attached to the bilge keels. He would then detach the warhead from the SLC and suspend it from the rope. If the water was very shallow, it could simply be left on the bottom underneath the target. (NARA)

sank. Another crew attached their warhead to a cargo ship. Belatedly realizing it was an Italian ship that had been pressed into service by the British, they removed the warhead and attached it instead to the 10,900-ton armed motorship *Durham*, which also sank. The remaining crew attached their warhead to the 15,893-ton tanker *Denby Dale*. *Denby Dale* sank, also taking with it a small tanker moored next to it. All six operators were recovered.

Operation *G.A. 3* – Attack on Alexandria

By November 1941, only two British battleships – HMS *Queen Elizabeth* and HMS *Valiant* – remained in the Mediterranean. Heavily protected in Alexandria harbor by minefields, nets, and magnetic detection cables, they became the targets of Operation *G.A. 3*. The operation was carefully planned, the SLC crews received extensive training, and the SLCs were thoroughly checked.

Through careful maneuvering, *Scirè* was able to approach to within about a mile of Alexandria harbor and release the three SLCs. The SLCs penetrated the harbor when the net gates were opened to allow three British destroyers to enter. The first SLC was able to locate *Valiant* and cross the antitorpedo net without difficulty. While attempting to pass beneath the hull, the SLC suddenly sank to the bottom 17m below. Diving after it, the pilot, Lieutenant Durand de la Penne, found a piece of wire had fouled the propeller. The other operator was missing. Still a few meters short of his target, de la Penne managed to drag his craft near the battleship. He surfaced and reached *Valiant's* mooring buoy, where he met his other crewman. They were found and taken aboard *Valiant*. The second SLC was able to locate *Queen Elizabeth*, pass through the antitorpedo net, and place its warhead. The crew reached shore and attempted to make their way to the designated pick-up point, but was later captured. *Valiant* and *Queen Elizabeth* sank in the shallow water of the harbor, but were eventually refloated and repaired. The third SLC badly damaged the 7,554-ton tanker *Sagona* and the destroyer HMS *Jervis* that was alongside for refueling; this SLC's crew was also captured.

Operation *G.A. 4* – Attack on Alexandria

In May 1942, two SLCs attempted to destroy the repair dock containing *Queen Elizabeth*. A third SLC targeted the submarine depot ship HMS *Medway*. Delivered by *Ambra* out of position and affected by strong currents and the presence of searchlights on shore, the crews became disoriented and were unable to reach the harbor. The crews independently decided to scuttle their vessels and try to escape. All were eventually captured.

Operation *N.A. 4* – Attack on Algiers

Following the Allied landing in North Africa in November 1942, an attack was ordered against merchant shipping in Algiers harbor and the associated roadstead in December. The plan consisted of a combined attack by combat swimmers against vessels in the roadstead and by SLCs against vessels in the harbor. Due to a delay in launching that prevented them reaching the harbor, the SLCs were subsequently ordered to attack targets in the roadstead. As the targets were to be merchant vessels rather than warships, the SLCs were each equipped with two 125kg warheads. One SLC suffered a malfunction and had to be abandoned before using its warheads, one attached both of its warheads to a single target, and the third placed its warheads on two targets as intended. The ships *Ocean Vanquisher* (7,174 tons) and *Berto* (1,493 tons)

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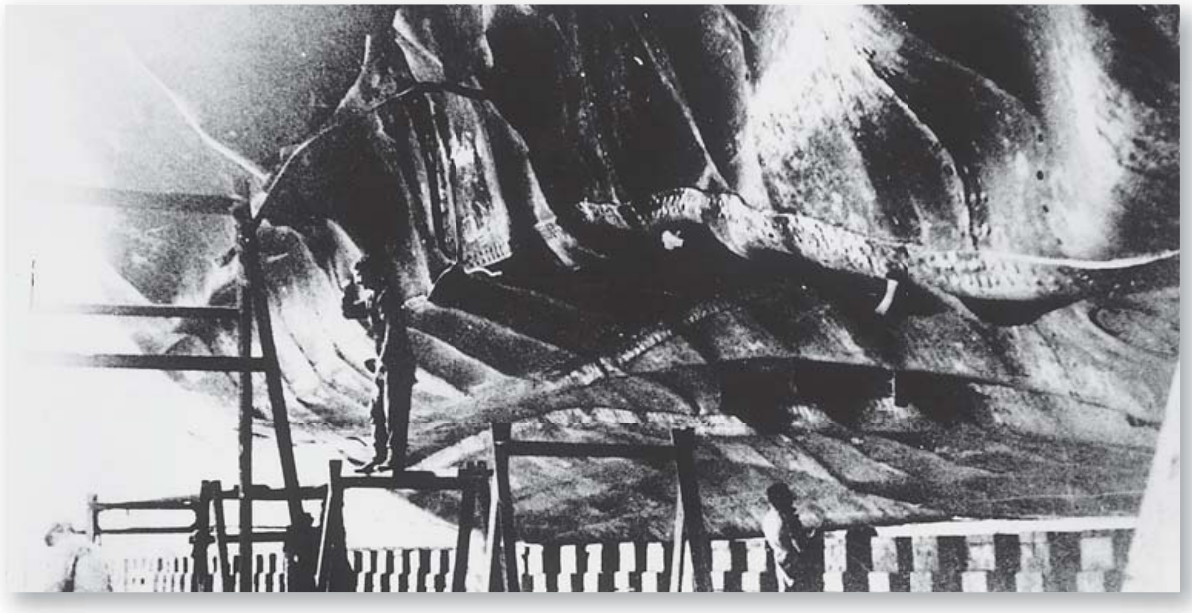


HMS *Valiant* in dry dock, showing the damage that resulted from the attack. (IWM FL5875)

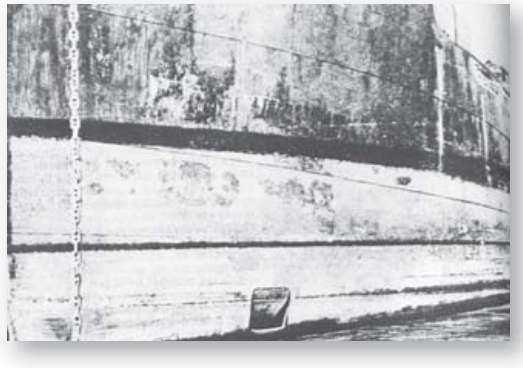
were sunk and *Empire Centaur* (7,041 tons) and *Armattan* (4,558 tons) were badly damaged by the combined efforts of the SLCs and combat swimmers.

Attacks on Gibraltar from the *Olterra*

The most interesting and dramatic operations were conducted against Gibraltar from a base secreted in the merchant vessel *Olterra*, interned in neutral Spain across the bay from Gibraltar's harbor. Spain had already been used to facilitate the return of 22 SLC operators to Italy after previous missions. Using Spain as a launching point for operations against Gibraltar would minimize the difficulties and risks faced by the operators and enable more frequent attacks to be mounted. The Italians were able to rent a bungalow overlooking the harbor to serve as an intelligence-gathering post and staging area. Maintenance and testing workshops were established in *Olterra*'s hold and a hatch cut below the waterline to allow the SLCs to enter and leave the vessel submerged. The SLCs arrived dismantled and packed in crates along with spare parts and other necessary supplies. Once aboard *Olterra*, the SLCs were reassembled and tested.

The *Olterra* served as the base for several successful SLC operations. Located within sight of the British port of Gibraltar, observers on the ship could watch their target directly using high-powered naval binoculars. Beached after the war, the *Olterra*'s underwater entry/exit port can be clearly seen. (Historical Archives, Italian Navy)

The first SLC operation from *Olterra*, *B.G. 5*, took place on December 7/8, 1942 and failed. The SLCs departed, but were forced to return to have problems with the steering assembly corrected. They departed again, but active British defenses soon detected the attackers. One SLC managed to return to the *Olterra*. Of the remaining two, one was sunk and the other scuttled by its crew. Three operators were killed and two taken prisoner.



The state of the Gibraltar defenses made any further attempt to force the harbor unacceptably risky. Therefore, merchant shipping in the roadstead was targeted in future operations. *B.G. 6* occurred on May 7/8, 1943. A storm made attaching the warheads to the targets difficult and doing so required multiple attempts. Three ships were attacked: the 7,000-ton liberty ship *Pat Harrison* and the 4,875-ton

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Camerata were total losses and the 7,500-ton *Mahsud* settled in shallow water, badly damaged.

The final SLC attack *B.G. 7*, in August 1943, sank the tanker *Thorshövdi* (9,944 tons) and damaged the freighters *Harrison Gray Otis* and *Stanridge*.

Midget Submarine Development

CA-Class

The CA-class was built as a private venture by the Caproni firm and based on the World War I-era A- and B-class submarines. They were originally armed with two 450mm torpedoes. Ordered by the navy, two were delivered in 1938. Designed for harbor defense and coastal patrol, their existence was secret and they were not listed on the naval register. CA 1 and CA 2 were mechanically fragile and lacked maneuverability while submerged. The introduction of the CB-class resulted in them being placed in storage.

The harsh environmental conditions faced by combat divers and their vulnerability led to the proposal to deliver them to their targets by small submarine. The original intent was to tow the divers using CB-class boats, but instead CA 1 and CA 2 were converted to specialist diver delivery vehicles.

CA 1–2(modified)/CA 3–4 (modified) Specifications	
Units in class	2/2
Displacement	12t/12.8t
Length	10m/10.4m
Beam	1.9m
Machinery	one 21kW (approx. 28hp) electric motor
Armament	eight 100kg charges and 20 3kg charges
Crew	three

The modifications eliminated the diesel engine, conning tower, and periscope; replaced the torpedoes with eight 100kg charges; and added a new electric propulsion unit, additional batteries, and a third crew member. A diver lockout chamber was also included following tests. The changes resulted in an increase in both range and speed, but further tests revealed that additional modifications were needed and the boat remained difficult to maneuver. The CA 3 and CA 4 featured improved access to the 100kg charges

A

ITALIAN MANNED TORPEDOES AND MIDGET SUBMARINES

The top profile is of the SLC manned torpedo, the type that carried out Italy's most dramatic midget craft missions. Originally designed to attack heavily armored warships, it had a single large detachable warhead. Later, two smaller warheads suitable for use against merchant vessels became available. The second profile shows the SSB manned torpedo. It was almost twice as fast as the SLC, had a longer range, better maneuverability and improved crew ergonomics. It was too late to see action but served as the basis for similar postwar Italian designs. The third profile is of the CB-class midget submarine. Developed by Caproni – a firm better known for its aircraft designs – the CB-class boats served mainly in the Black Sea against the Soviets. Profile 4 is the Marconi-class submarine *Leonardo da Vinci,* modified to carry the CA-2 midget submarine. With its deck gun removed and a well and clamps installed to hold the midget, the modified *Da Vinci* was slated to participate in an attack on New York City's port. The bottom profile shows the "600"-class/Adua-series submarine *Scirè* modified with three external pressure vessels for transporting SLCs. The pressure vessels allowed the submarine to operate below the crush depth of the SLC, improving its survivability. *Scirè* took part in numerous SLC missions before being sunk off Haifa while delivering combat swimmers.

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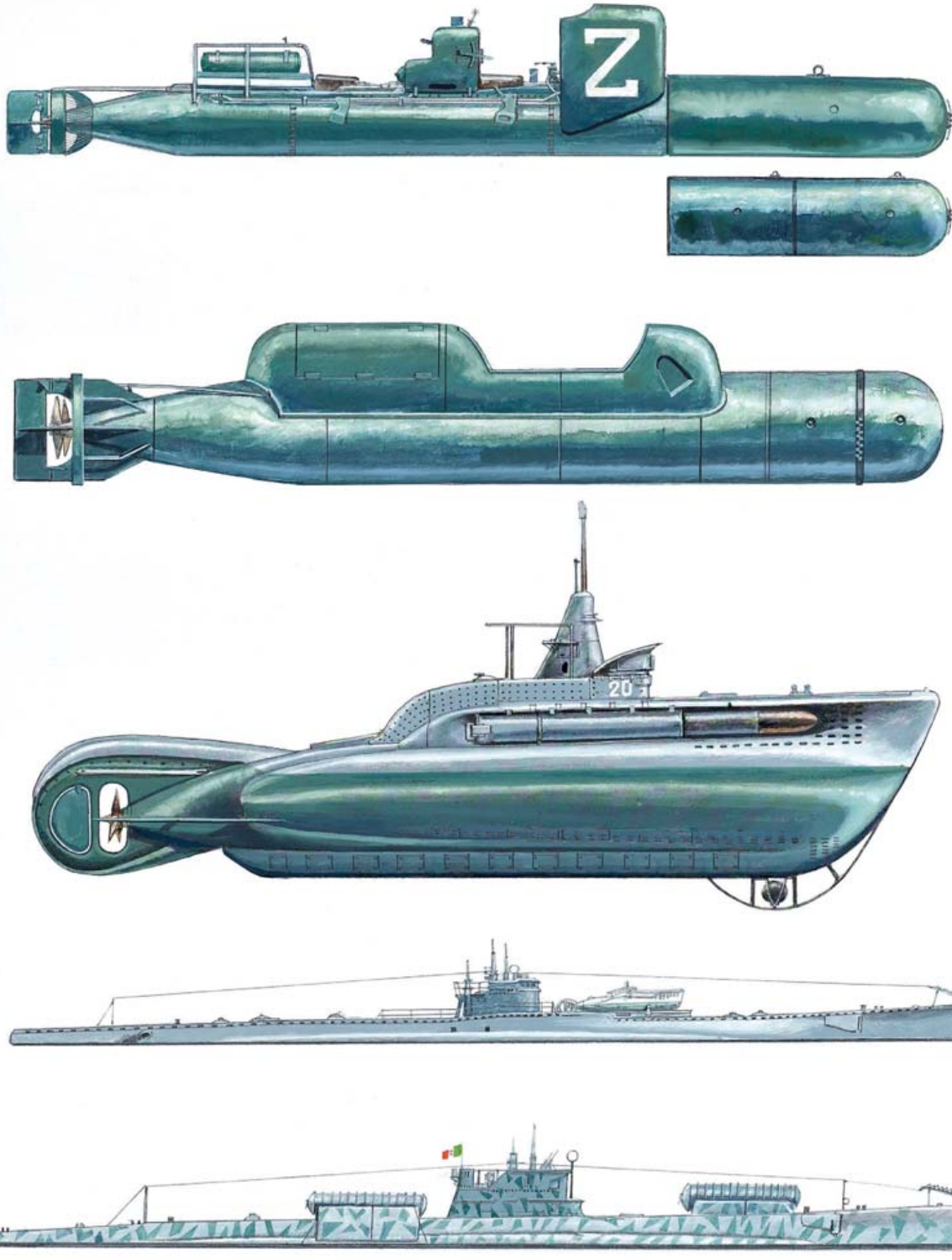

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CA 2 is seen here aboard the modified *Leonardo da Vinci*, clamped securely in the well. The tests demonstrated the technical feasibility of operating the midget from the larger boat, but the planned attack on New York was never carried out. (Dr Achille Rastelli)

and better maneuverability through the addition of forward hydroplanes.

The strong Allied defenses in the Mediterranean led to another proposal for an attack on the port of New York, this time using the modified CAs to deliver combat divers. An attack there would have a large psychological impact and serve to divert defensive resources from elsewhere. The initial plan called for the use of two CAs delivered to the US by one German and one Italian oceangoing submarine. The CAs would be transported to the mouth of the Hudson River and proceed into the port to release the divers. The plan was later scaled back when Germany decided it could not make a submarine available for the project. Tests in 1942 off Bordeaux, from where the attack was to be launched, demonstrated that CA 2 could be transported, launched, and recovered by the specially modified Marconi-class submarine *Leonardo da Vinci*. The attack was planned for December 1943 but not executed due to the armistice.

In addition to New York, attacks were considered against the ports of Freetown, Sierra Leone and Cape Town, South Africa.

CB-Class

CB Specifications	
Units in class	22 (possibly 26)
Displacement	35t
Length	15m
Beam	3m
Machinery	one 90hp diesel engine/one 100hp electric motor
Range (surfaced/submerged)	1,400nm at 5kt/50nm at 3kt
Armament	two 450mm torpedoes
Crew	four

An improved version of the CA-class, the CBs retained the two torpedoes carried semi-exposed in external tubes and its harbor defense/coastal patrol missions. It had the features common to larger submarines, with a hydrophone (initially placed on the deck but later moved to the keel to permit its use while surfaced) and the ability to recharge the batteries using the diesel engine. The boats performed well and acquisition was expanded in 1943 as Italy's naval losses mounted and the need for coastal/harbor defense increased. At least 22 and perhaps as many as 26 were completed, some after the armistice.

Midget Submarine Wartime Service

The first two CB-class boats entered service on January 27, 1941. Together with CB 3–6 they formed the 1st CB Squadron, operating from Salerno. The squadron began operational patrols in September, conducting approximately 35 missions.

In April 1942, the squadron was transferred to the Black Sea port of Yalta to help interdict supplies destined for Sevastopol. There it conducted almost 70 missions, claiming the sinking of two Soviet submarines for the loss of CB 5,

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sunk in port during an attack. Following refitting at Constanza, Romania, the remaining five CBs continued operations before being transferred to Sevastopol. From there they conducted 21 missions, claiming the sinking of a third Soviet submarine. A heavy cruiser was also attacked, but both of the torpedoes fired malfunctioned, possibly as a consequence of being carried externally and semi-exposed. After the armistice, the boats continued to support German operations. Redeployed to Constanza, they were interned by the Romanians. They were turned over to the Italian Social Republic (RSI) a short time later and took part in minor operations. Four were later captured and served in the Soviet Navy until early 1945. The 2nd Squadron – CB 7–12 – saw less service, some of the boats not seeing action until after the armistice. CB 8–12 were ultimately incorporated into the Italian Navy fighting with the Allies, and completed 48 combat missions. They remained in service until 1948.

The Germans captured CB 13–16 while they were still under construction. CB 13–15 were later destroyed by Allied air attacks and CB 16 was turned over to the Tenth Flotilla, but its crew mutinied during an operation and surrendered their vessel to the British.

CB 17–22 were completed by Caproni after the armistice, turned over to the Tenth Flotilla, and took part in landing saboteurs and reconnaissance missions. They had varied fates: CB 17 was sunk during an air attack, CB 18 was scuttled by its crew, CB 19 was turned over by its crew to the new Italian government fighting with the Allies, CB 20 was captured by Tito's partisans, CB 21 was accidentally rammed by a German landing craft, and CB 22 was either sunk in an air attack or scuttled by its crew.

The status of CB 23–26 is uncertain. Records indicate they were built, but probably not completed.

An interior view of CB 20, looking forward. At the top can be seen the periscope, the only place on the boat where it is possible to stand upright. CB 20 was incorporated into the Yugoslav Navy after the war. Restored to its original condition, it is part of the collection of the Technical Museum in Zagreb. (Tihomir Bregar)

Prototypes and Concepts

Dolphin Assault Submarine

A very fast – 45kt surfaced and 20kt submerged – one-man vessel. Approximately 6m in length and with a diameter of 1m, the tapered hull was fitted with a torpedo tube in the bow and side fins that reduced resistance when traveling on the surface. Dolphin would be able to dive dynamically to 20m, submerged travel being powered by compressed air; the compressed air cylinders – which also provided breathing air – could be refilled if necessary using an on-board compressor. It was equipped with a snorkel and periscope and intended to be fitted with a 150hp engine. The concept was presented in 1941 and a prototype tested in late 1944.

Campini-De Bernardi Semisubmersible

Essentially a large, one-man torpedo designed to travel at periscope depth. Two 450mm torpedoes were envisioned as the armament. Proposed in 1942, it did not proceed beyond the concept stage.

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The same vessel, looking aft into the engine compartment. In the foreground is the diesel engine. Behind it one can see the generator and electric motor. Overhead is an air cylinder. (Tihomir Bregar)

Sassaroli Fast Assault Submarine

Built of plywood with a cast iron keel, this one-man submarine had a length of approximately 8m. The operator was provided with a short conning tower with three windows. The armament consisted of an underslung torpedo and attacks were to be conducted while the vessel was surfaced. It was driven by a 200hp closed-cycle gasoline engine that drove two contra-rotating propellers designed to provide a speed of 20kt on the surface and 30kt submerged. A prototype was partially completed.

Minisini Assault Submarine

The Minisini featured contra-rotating propellers placed at the bow. It had two pairs of hydroplanes and diving was done dynamically. A single alcohol-fueled, closed-cycle engine powered the vessel on the surface and submerged. It was armed with an underslung 450mm torpedo.

Analysis and Conclusion

Manned torpedoes and midget submarines were an important adjunct to Italy's large force of oceangoing and coastal submarines. Benefitting from its prewar experience, Italy entered World War II with vessels of fundamentally sound design. However, mechanical problems of all types dogged the SLCs, the mainstay of Italian midget craft operations. Greater attention to preparing them prior to operations eventually greatly reduced the number of equipment-related mission failures. With the notable exception of the disastrous attack on Malta, operational plans were straightforward, executed aggressively, and reflected a reasonable degree of risk for the expected gain.

As suggested in J. Valerio Borghese's classic *Sea Devils*, perhaps Italy's most serious failure was the missed opportunity to take full advantage of its temporary naval dominance resulting from the attack on *Valiant* and

B

ATTACK ON HMS *VALIANT*

This scene depicts Lieutenant Durand de la Penne's effort to position his SLC beneath the battleship HMS *Valiant*. On reaching his target, his motor failed due to a fouled propeller, sending his craft to the bottom. He managed to locate his SLC, but not his other crewman, Petty Officer Emilio Vianchi. Fearing Vianchi would be discovered and the British alerted, Durand de la Penne slowly dragged his SLC toward *Valiant*. His craft's luminous compass obscured by disturbed sediment, he was guided by machinery noises coming from *Valiant*. After completing his task he surfaced and found Vianchi. Both were captured and taken aboard *Valiant*. Just before the warhead detonated, he warned the ship's captain, allowing *Valiant*'s crew to be evacuated from the lower decks. *Valiant* was badly damaged and out of the war for the next eight months. After the armistice, Durand de la Penne would be decorated for bravery by Rear-Admiral Charles Morgan RN, the *Valiant*'s captain at the time of the attack. Sudden uncommanded dives by the SLC were not unusual and could be caused by a number of mechanical faults or even abrupt changes in salinity, a common occurrence when operating near estuaries.

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The CB-class boats were most active in the Black Sea. Shown here are four of the six CBs assigned to the 1st CB Squadron, deployed there to assist the Germans in their attempt to isolate Sevastopol. They are in port at Sevastopol after the city's capitulation and torpedoes can be seen loaded in the external partial tubes. (In Guerra Sul Mare)

Queen Elizabeth. Coupled with earlier losses, their incapacitation left Britain in a position of serious naval weakness in the Mediterranean. Italy used its freedom of action to provide important support to ground operations in North Africa. A more aggressive approach might well have proved to be decisive. In the end, Britain had enough time to transfer sufficient forces to restore its former position.

While not war-winning weapons, Italy's manned torpedoes and midget submarines made a useful contribution. Few in number, they were certainly more successful than their larger counterparts, which between June 1940 and September 1943 managed to sink only ten warships (none larger than a light cruiser) and 15 merchant ships at the cost of 66 submarines.

GERMANY

History and Doctrine

Although midget craft had been proposed as part of Germany's prewar rearmament program, the navy's leadership was unenthusiastic and instead focused on the development and production of large, oceangoing conventional submarines and associated doctrine. It was not until 1943, when the course of the war had already begun to turn against Germany and the prospect of an Allied invasion loomed, that a concerted effort was made to design and field manned torpedoes and midget submarines.

The first manned torpedoes were intended to attack stationary or slow-moving enemy vessels off the invasion beachheads. As more capable midget submarines were introduced, the mission set was broadened to include attacks on coastal shipping.

For the most part, designs were constrained by the need for craft that were easily transportable and capable of being launched from austere locations. The vessels imposed constraints of their own. They were necessarily armed with torpedoes having reduced battery capacity that limited their speed and range. Loading the torpedoes required lifting the vessels using mobile or stationary cranes that were not always readily available.

The first-generation midgets, the Neger and Marder, were developed quickly and limited to using readily available materials. The design of the second generation of midgets, while it marked improvements over the first, reflected the same urgency of development and limitations on materials. The war was almost over before the Germans were able to field a well-designed and highly effective third-generation midget submarine, the Seehund.

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Manned Torpedo Development

Neger/Marder/Hai Specifications	
Units in class	approx. 200/approx. 300/one prototype
Displacement	2.7t/3t/approx. 3.5t
Length	7.6m/8.3m/11m
Beam	0.5m/0.5m/0.5m
Machinery	one 12hp electric motor
Armament	one underslung G7e TIIIb torpedo
Range (surfaced)	48nm at 4kt/48nm at 4kt/63nm at 3kt
Crew	one

Neger

These semisubmersibles were created by modifying the proven G7e torpedo. The principal alteration was the replacement of the warhead with a cockpit covered by an acrylic dome. The operator had simple controls (a stick for the rudder, a throttle for the electric motor, and a torpedo release lever), a self-contained Draeger breathing apparatus, and a wrist compass. A graduated scale around the base of the dome and a spike on the nose allowed rudimentary aiming.

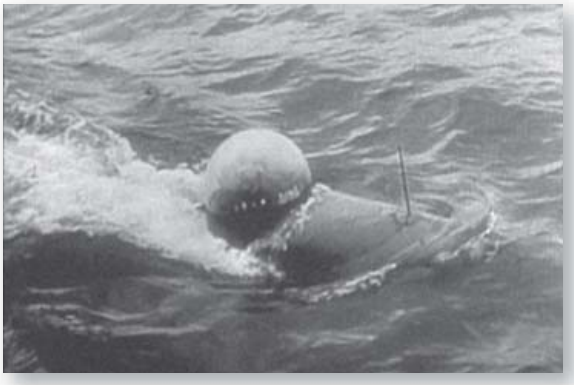
The operator's position near the water's surface, the tactical imperative for night operations, and the tendency of the dome to become obscured hampered visibility and target acquisition. The Neger's slow speed and the inability to travel submerged reduced survivability. Limited range usually required use of improvised launching areas near their target, usually a stretch of suitable shoreline with the approaches reinforced with fiber mats or wooden ramps. Clear weather and calm seas were a necessity for successful operations and strong currents could restrict their use.

Marder

This was essentially a Neger lengthened to accommodate a 30-liter diving tank. This enabled the Marder to dive to 10m, correcting the Neger's primary shortcoming. As with the Neger, however, firing was conducted from the surface. Compressed air cylinders allowed the Marder to submerge up to 20 times. Depth and inclination gauges were provided, as was a separate breathing air system for the operator.

To compensate for the Marder's limited range, in early 1945 the Type VIIC U-997 was fitted with brackets to enable her to carry two Marders on each side. The Type VIIC's submerged depth was limited to 40m – the crush

With the dome barely above the surface and his vessel's simple aiming spike protruding to his front, a Neger or Marder crewman pilots his craft. Operating at night and with any degree of swell, simply identifying a target would be a problem for the operator. (NARA)



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LEFT
A Marder loaded with an exercise torpedo waits on its trailer. The trailer had to be manhandled across the beach and into water deep enough to allow the vessel and its attached torpedo to float off. It was a difficult and frequently unsuccessful task. (NARA)

RIGHT
The Marder cockpit was extremely sparse. With his right hand on the stick that controlled the rudder and hydroplanes, the Marder's pilot prepares to release his torpedo using the lever in his left hand. Visible are the depth and pressure gauges; an inclinometer was fitted on the inside of the dome. (NARA)

depth of the Marder – and it had to surface to allow the operator to board the Marder. Although tests were successful, it was not used operationally.

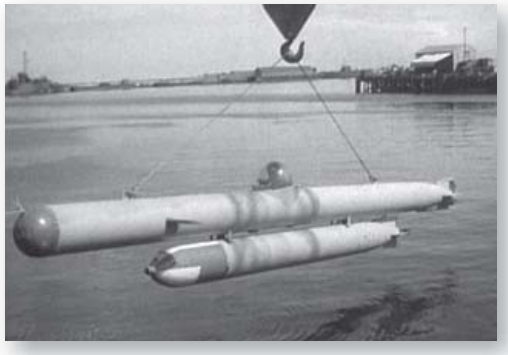
Hai

A further development of the Marder, Hai paired the head and tail section from the Marder with two torpedo center sections. This doubled the battery capacity, improving speed and range. It was also equipped with a "Hase" acoustic detection system and front-mounted diving planes. Due to its increased length, it had poor maneuverability and sea keeping. It was still under development when the war ended.

Manned Torpedo Wartime Service

On the night of April 20/21, 1944, the first Neger attack took place against the invasion forces in Anzio harbor and the associated roadstead and Nettuno Bay. Five hundred troops were detailed to help launch the Negers down the fiber mat runways into water deep enough to allow the midgets with their underslung torpedoes to float off their trailers. On entering the water, the trailers tended to leave the runways and become stuck. For this reason, of the 37 available Negers (three having been lost en route when they slipped from their trailers), 14 were unable to be launched and were later destroyed. Only ten of the remainder, guided by preplanned illuminating rounds fired by German artillery, reached their target areas. Two patrol craft and a small cargo vessel were sunk. Ten Negers were lost in action, including four claimed sunk by the Allies and two captured.

Two attacks were launched against the Normandy beachhead. On July 5/6, 26 Negers were launched, damaging the destroyer HMS *Trollope* so badly that she was declared a total loss and sinking the minesweepers HMS *Cato* and HMS *Magic*. Ten Negers were lost. The second attack on July 7/8 by 21 Negers resulted in the minesweeper HMS *Pylades* being sunk and the Polish cruiser ORP *Dragon* damaged. *Dragon* was later scuttled. All 21 Negers were lost.



Hai's forward mounted hydroplanes were meant to improve maneuverability, but it still performed poorly. It was only produced in prototype form. (NARA)

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Another Neger attack resulted in the sinking of the destroyer HMS *Isis* with the loss of all but 20 of her crew on July 20. A combined attack by 58 manned torpedoes – Negers of K-Flotilla 361 and Marders of K-Flotilla 362 – and Linse explosive boats in early August sank three ships: the destroyer HMS *Quorn*, a minesweeper, and a Landing Craft, Gun. Two transport ships were badly damaged. Also torpedoed was the cruiser HMS *Durban*, which had been previously scuttled as part of the invasion area breakwater.

An intended attack by 53 Negers of K-Flotilla 363 on August 15/16 was hampered by very bad weather, with only 11 being launched successfully. Seven of these were forced to abort the mission. Another attack the following day resulted in the sinking of the barrage balloon vessel HMS *Fratton* and a landing craft for the loss of 26 of the attacking vessels. Several Marder flotillas were transferred to Italy, but operations there were unsuccessful and almost all the Marders committed to action were lost.

A Neger with its torpedo still attached is examined by US troops following its combat debut at Anzio. As at Anzio, subsequent operations involved heavy losses for little gain. (NARA)

Midget Submarines

Hecht (Type XXVIIA) Development

Hecht Specifications	
Units in class	53
Displacement	11.8t
Length	10.6m
Beam	1.7m
Machinery	one 12hp electric motor
Armament	one G7e TIIIc torpedo
Range (submerged)	with standard battery: 38nm at 4kt with additional battery unit: 69nm at 4kt
Crew	two

Hecht was originally designed to attack ships at anchor, much like the British X-craft, and was armed with a single mine at the front of the hull that could be released from inside the vessel. It was optimized for submerged travel, with a gyrocompass and compensating tanks, but no diving tanks. Small and powered by a 12hp torpedo motor, it was intended that it be transported near its operational area by a surface vessel. Hecht could dive to 50m.

After the design had been completed, Hecht's mission was broadened to include engaging moving targets in coastal areas. Accordingly, a requirement for the ability to carry a torpedo in place of the mine was added and the requirement for a gyrocompass was dropped (although one was ultimately installed). If the torpedo was carried, a unit containing additional batteries to extend the operating range replaced the mine. A diver lockout chamber for two combat swimmers was also considered as an alternative to the mine, but its development was not pursued.

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Three prototype (U2111–2113) and 50 series production (U2251–2300) boats were built between May and August 1944. Hecht was an unsatisfactory boat, lacking maneuverability and having high drag and poor submerged handling qualities. In addition, the original requirement for a gyrocompass increased the boat's displacement and decreased its operating range through additional power consumption.

Hecht War Service

Given its limitations, Hecht was used as a training vessel, with the additional battery unit replacing the mine.

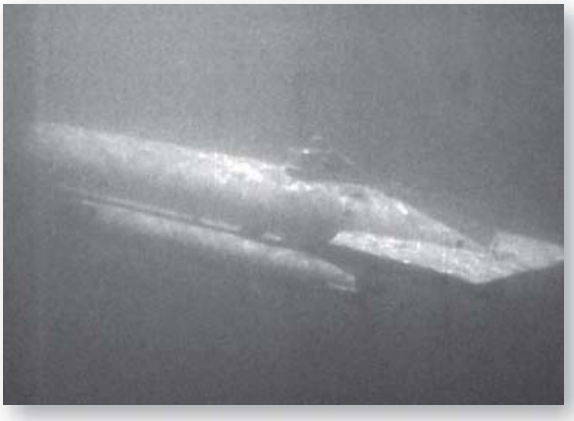
Molch Development

Molch, reflecting lessons learned concerning the vulnerability of the semisubmersible Neger, was designed to travel submerged. Like the semisubmersibles, it used readily available torpedo components and was designed to be simple to build in order to facilitate production. Its propulsion unit was an electric torpedo motor powered by batteries that occupied most of Molch's length. Two torpedoes were suspended under rails attached to the lower hull. Its underwater range was better than Hecht's and much better than Biber's. Molch's normal diving depth was 40m, but it could reach 60m.

Molch Specifications	
Units in class	383
Displacement	11t
Length	10.8m
Beam	1.8m
Machinery	one 13hp electric motor
Armament	two G7e TIIIc torpedoes
Range (submerged)	50nm at 5kt plus 50nm at 3.3kt
Crew	one

The operator had a short conning tower with windows, surmounted by a small acrylic dome that carried the night aiming device. There was a non-retractable periscope with a limited adjustment of 30° to each side and a magnetic projection compass. There was also a wheel for steering and stick for depth control; compressed air cylinders and valves for the diving, trim, and compensating tanks; an on/off switch for the motor and a foot pedal that gave a choice of two speeds; and torpedo release pedals. The operator had a breathing system with air for 50 hours.

These photos show Molch both below the water – where it had good performance – and on its trailer. While built in large numbers, catastrophic losses in its first actions led to its being withdrawn from active service. (NARA and IWM A28978)



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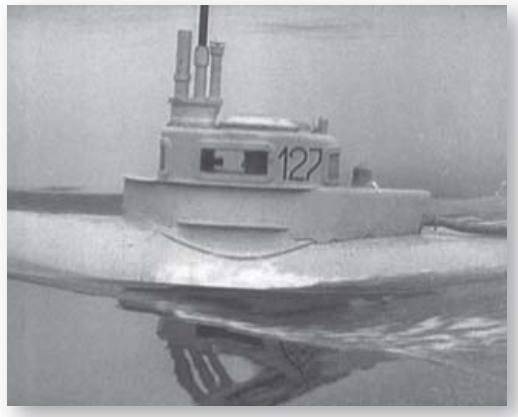
The operator's workload was heavy and the large control surfaces at the stern – optimized for submerged travel – made handling on the surface difficult.

Molch War Service

Molch K-Flotillas 411 and 364 were first deployed to Italy against invasion forces participating in Operation *Dragoon*, but operations there were unsuccessful, with the loss of ten of 12 Molchs. No Allied vessels were lost. Operations from Holland by K-Flotilla 412 were also unsuccessful, again with heavy losses. Eight out of 12 Molchs were lost on February 21/22, 1945 and 14 out of 16 were lost on March 12/13. Their poor operational record resulted in Molch being held in reserve.



ABOVE AND BELOW
A Biber operator mans the controls in his cramped cockpit. The two concentric wheels to his front controlled the rudder and hydroplanes. On either side of the wheels can be seen the dials showing the rudder and hydroplane position. Also visible are the gauges for oil pressure, oxygen pressure, battery voltage, and high- and low-pressure air. The large dial to the upper left is the depth gauge. It was a complex boat for its size and a challenge for one crewman to operate. (NARA and IWM MH29893)

Biber Development

Inspired by a captured British Welman midget submarine, the Biber was Germany's smallest U-boat. The prototype, called "Adam," was designed and built in a little over one month and initial tests were very satisfactory. Four prototype, 20 training, and 300 combat vessels were ordered and delivered between May and November 1944.

Biber Specifications	
Units in class	324
Displacement	6.3t
Length	9m
Beam	1.6m
Machinery	two 32hp gasoline engine, one 13hp electric motor
Armament	two G7e TIIIc torpedoes
Range (surfaced/submerged)	100nm at 6kt/8.6nm at 5kt plus 8nm at 2.5kt
Crew	one

The hulls, made of three sections bolted together, were built both in Germany and by the Ansaldo firm in Italy. Despite the risks, a 2.5-liter 32hp Opel-Blitz gasoline engine was installed because it was available in large quantities; it also had the benefit of running quietly. A snorkel was fitted to provide combustion air. It gave a surfaced speed of 6.5 knots. For submerged travel, a 13hp electric torpedo motor allowed a speed of 5.3kt.

The operator had a short conning tower with four windows, and a periscope provided additional visibility in the forward arc. There was 45 minutes of breathing air in the compartment and a breathing air cylinder; the system was designed for 20 hours of submerged travel. Four compressed air cylinders served the forward and aft diving tanks. There were no trim or compensating tanks, which required the operator to make adjustments dynamically or by using the diving tanks. This placed heavy demands on the operator and made it difficult to maintain periscope depth, so attacks were carried out on the surface.

Two torpedoes were carried in large semicircular recesses in the hull. Adopted primarily to minimize overall width during land transport, this also reduced drag in the

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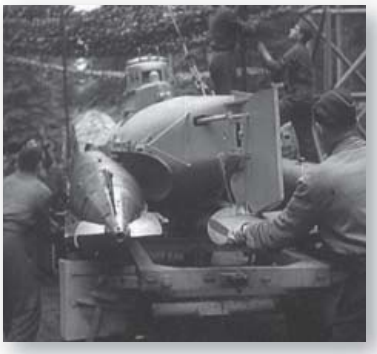

This series of photos depicts operations in the field. A Biber is lifted on a crane and its torpedoes are loaded. It is then rolled down an improvised ramp into the water where other, previously launched Bibers are tied up. The bands that attach the torpedoes to the boat are evident. (NARA)

water but lessened the strength of the hull. To prevent damage to the torpedoes during grounding, skids were fitted to the bottom of the hull. Mines could be carried in place of torpedoes and, being heavier than the torpedoes, were fitted with floats at either end.

Biber's handling qualities were very good, but its small size limited its effective employment to good weather. Normally a mission was intended to last one or two days; the longest recorded mission was four days.

Biber War Service

The first Biber attack was launched by K-Flotilla 261 from Fécamp in August 1944. It was unsuccessful largely due to bad weather, 12 of the 16 boats launched having to return before even reaching the target area. Operating from Rotterdam, Bibers conducted operations against shipping in the Scheldt estuary. Over a three-month period in late 1944 and early 1945, approximately 110 sorties were conducted. They accomplished little and were hampered by harsh currents and 60–70 percent losses due to variety of causes. In March, disaster struck. Bibers were preparing for a mission when a torpedo accidently launched, hitting another Biber armed with mines. The resulting detonations sank 20 Bibers in the basin.

In January 1945, three Type VIIC U-boats, each carrying two Bibers on deck, departed Norway with the intent of launching the Bibers against vessels in an anchorage off Murmansk. Trials had proved this was practical, and the crews were to be recovered by a waiting U-boat. The attack was called off when it was discovered that all the Bibers developed fuel-line or water leaks, attributed to vibration from the Type VIIC's engines.

Also in January, Bibers attempted to destroy the road bridge over the Waal River at Nijmegen. After earlier, only partly successful attempts by

C

THE GERMAN OPERATIONAL VESSELS

The top profile is of the Neger manned torpedo. A semi-submersible, the Neger was rushed through development and built in large numbers to combat the expected invasion of Europe. Its crews received minimal training and, restricted to the surface, they suffered heavy casualties. The second profile shows the Marder, essentially a Neger lengthened to include a diving tank that allowed it to submerge. This improvement made little difference and, like their predecessors, Marders had little operational impact and were destroyed by the Allies in large numbers. The third profile is the Biber midget submarine. Biber's small size and custom trailer made it easy to transport, but its single crewman was badly overworked. The bottom profile shows the Molch. An all-electric boat, Molch had very good handling when submerged. Like the Biber, it was handicapped by having only a single crewman. It too had a dismal operational record.

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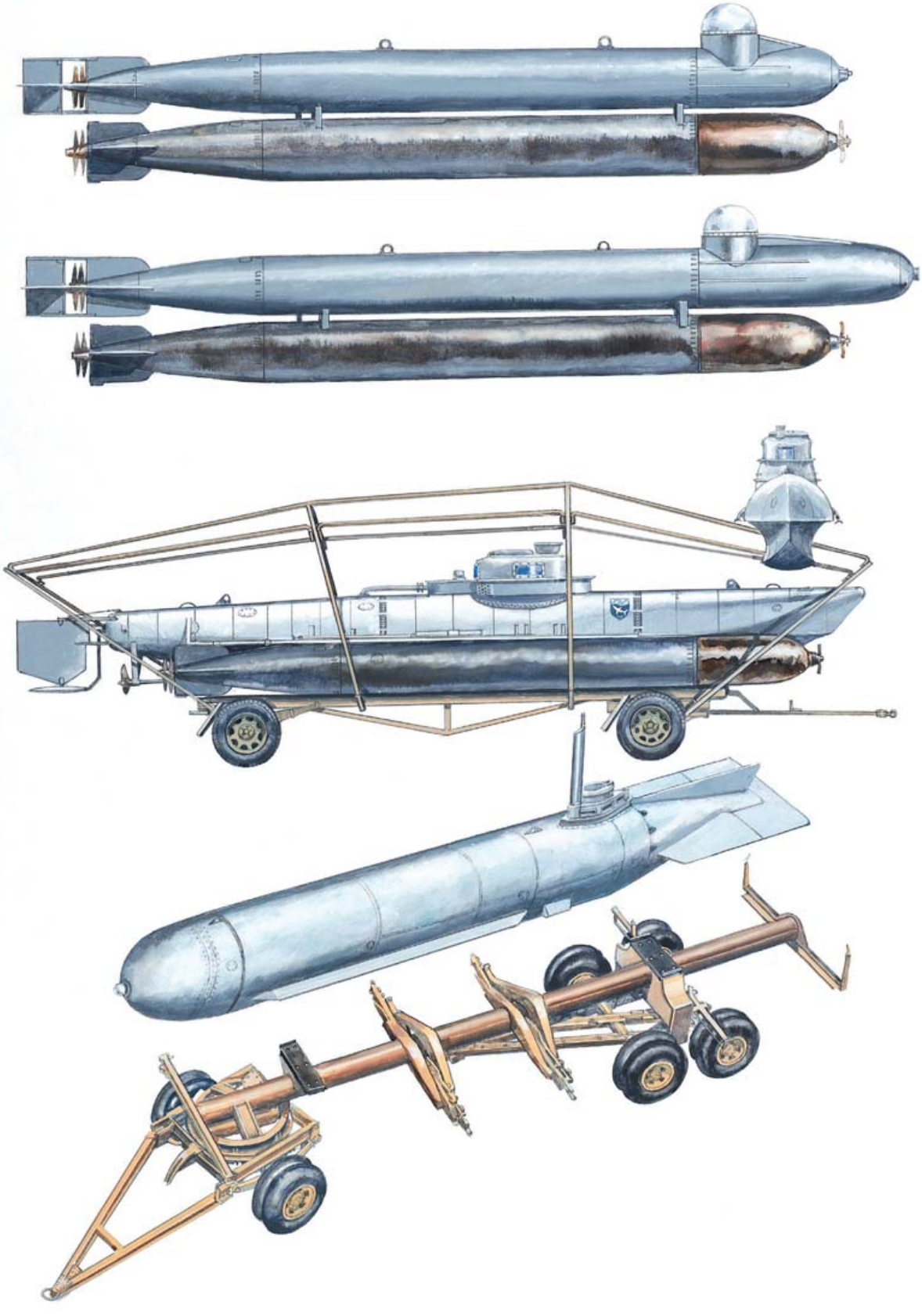

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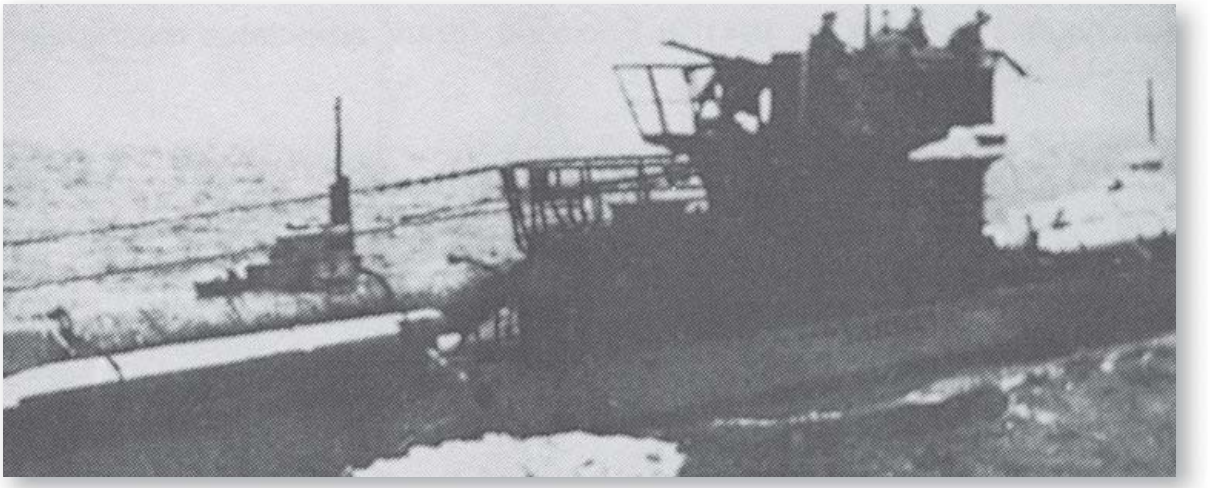

The Biber's short range meant that it would have to be transported to a distant operational area. Here two Bibers are carried exposed on the deck of a larger U-boat. A planned attack on an anchorage near Murmansk had to be canceled when all six Bibers developed mechanical problems from being carried in this manner. (*Weapons of Desperation*)

combat swimmers to destroy the Waal bridges, floating mines were released to destroy the defensive obstructions. Twenty Bibers firing torpedoes equipped with hooks were to clear away any remaining obstructions, followed by four Bibers towing tree trunks from which three-ton mines were suspended. According to Allied after-action and interrogation reports, one Biber was destroyed by artillery fire and seven others ran aground. The road bridge was undamaged.

A proposed plan to employ the Biber to close the Suez Canal by sinking a transiting ship was not carried out. Taking advantage of the Biber's small size, the plan was to transport it to its operating area by a six-engine BV-222 flying boat.

By the end of the war, Germany withdrew most Bibers from service and only operated a few for mine laying.

Seehund (Type XXVII B5/Type 127)

Seehund Specifications	
Units in class	285 (U5501–6442)
Displacement	14.9t
Length	11.9m
Beam	1.7m
Machinery	one 60hp diesel engine, one 25hp electric motor
Armament	two G7e TIIIc torpedoes
Range (surfaced/submerged)	270nm at 7kt/63nm at 3kt
Crew	two

Seehund was Germany's first true midget submarine and the most advanced of those produced in quantity. Produced from September 3, 1944 through April 1945, it had all the key features of the larger U-boats. It also represented a departure from previous efforts to field vessels that could be operated from improvised and austere launching points along the coast, freeing designers from the constraints that requirement imposed.

The project requirement called for a vessel:

- suitable for both surfaced and submerged operations
- armed with two torpedoes

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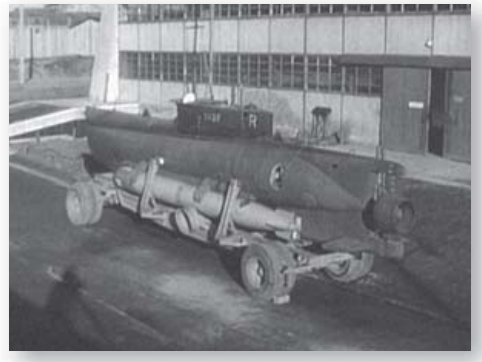
- equipped with a diesel engine and electric motor
- capable of 48 hours endurance at four knots submerged with two crew.



Seehund was the most successful and capable of its midget craft. While highly successful, its late entry into service limited its impact. The Kort nozzle rudder seen here was introduced in an attempt to improve its ability to turn compared to the blade rudder initially fitted. (NARA)

Following a series of variations designated Type XXVII B1 through B4, the design was finalized as the Type XXVII B5. It possessed a low profile above the water, good sea keeping and maneuverability, and could quickly dive dynamically using the diesel engine. The design depth was 30m, although 70m was achieved during operations. Its 270 nautical-mile-surfaced range could be extended to 500 nautical miles through the use of external fuel tanks. The electric motor gave a submerged range of 63 nautical miles and the batteries could be recharged while the vessel was running on diesel power. A typical mission lasted five days, the longest 11.

Seehund production was considered a defense priority, and it was envisioned that 1,000 – later reduced to 600 – would be built. Allied attacks caused material shortages and transportation delays, particularly of batteries. In addition to the 285 boats produced, 93 others were under construction at the end of the war. After the war, Seehunds were incorporated into the French Navy.

Seehund War Service

The first Seehund mission, launched from IJmuiden in Holland on December 31, 1944, ended in disaster. The 18 Seehunds encountered a storm and only two returned. While a second sortie on January 17 caused no enemy losses, all ten Seehunds returned safely. The first kill by a Seehund occurred in February when a freighter was sunk off Great Yarmouth. Allied use of well-defined convoy routes between the Thames and the Scheldt, coupled with excellent signals intelligence on convoy movements, resulted in approximately 70 percent of Seehunds making contact with the enemy and the sinking of 120,000 tons of shipping. Seehund operations also resulted in the diversion of Allied naval and air resources to antisubmarine operations. The final Seehund sorties delivered food, carried in external containers called "butter torpedoes," to the surrounded German garrison at Dunkirk.

Prototypes and Concepts

Biber II and III

Biber II was a larger version of the Biber, able to accommodate a crew of two who would alternate operating the vessel. Biber III featured a closed-cycle diesel engine and highly modified hull shape. Its long operating range (1,500 nautical miles at six knots surfaced plus 100 nautical miles at five knots submerged) would have severely taxed the crew. Consideration was also given to equipping Biber III with a tracked chassis.

TYPE 227

TYPE 227 was a Seehund with a closed-cycle engine. Although tests were successful, development occurred too late in the war for production.

Type XXXII

A small two-man boat, Type XXXII was similar to the Hecht, but optimized for operations in the confined space of the English Channel. Two torpedoes were mounted above the hull, enabling easy reloading while in the water and permitting the vessel to rest on the bottom if necessary. Equipped with batteries and a 25hp electric motor, Type XXXII was to have an endurance of four days.

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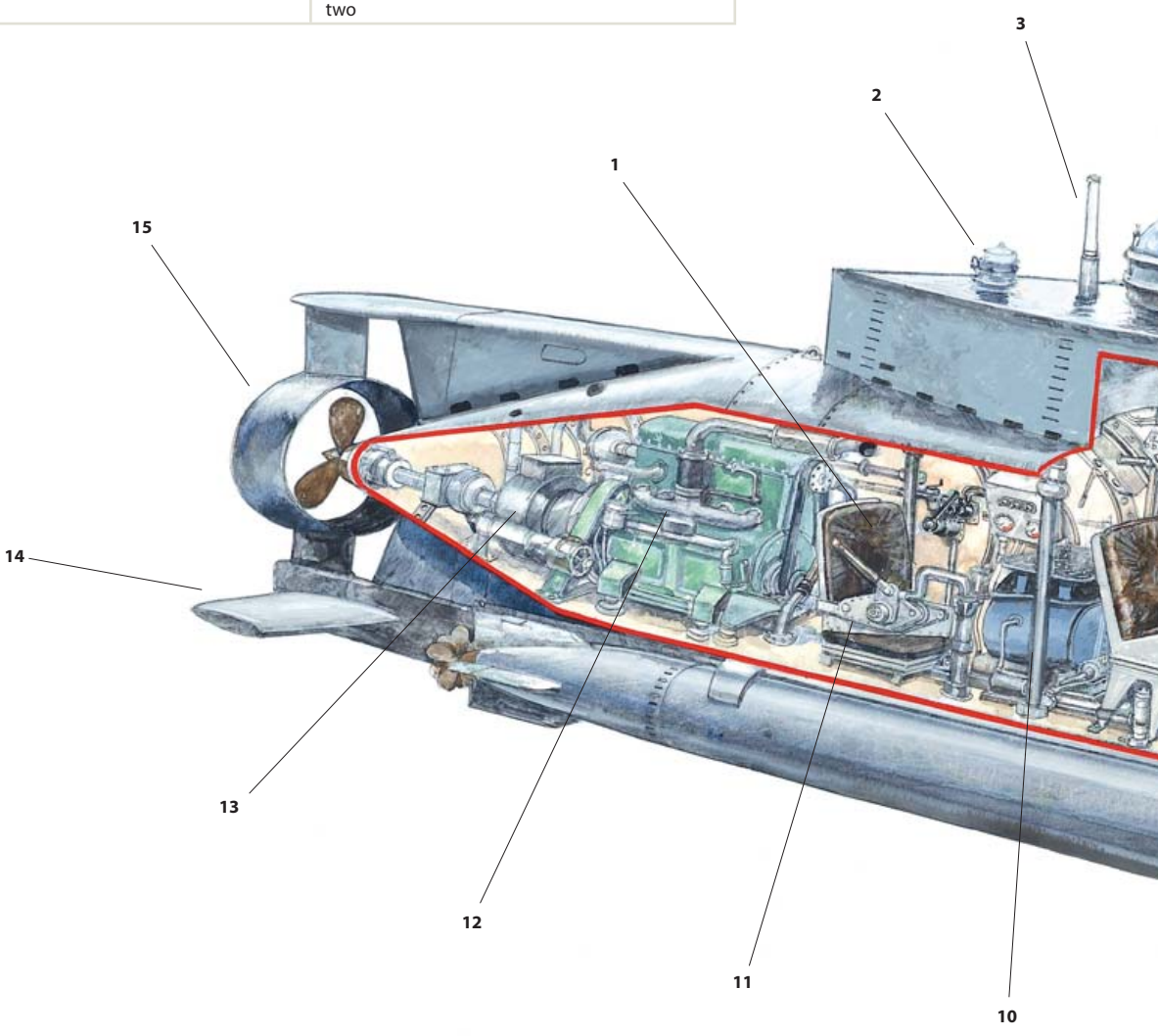
D SEEHUND (TYPE XXVII B5/TYPE 127)

Technical Specifications	
Units in class	285 (U5501–6442)
Displacement	14.9t
Length	11.9m
Beam	1.7m
Machinery	one 60hp diesel engine, one 25hp electric motor
Armament	two G7e TIIIc torpedoes
Range (surfaced/submerged)	270nm at 7kt/63nm at 3kt
Crew	two



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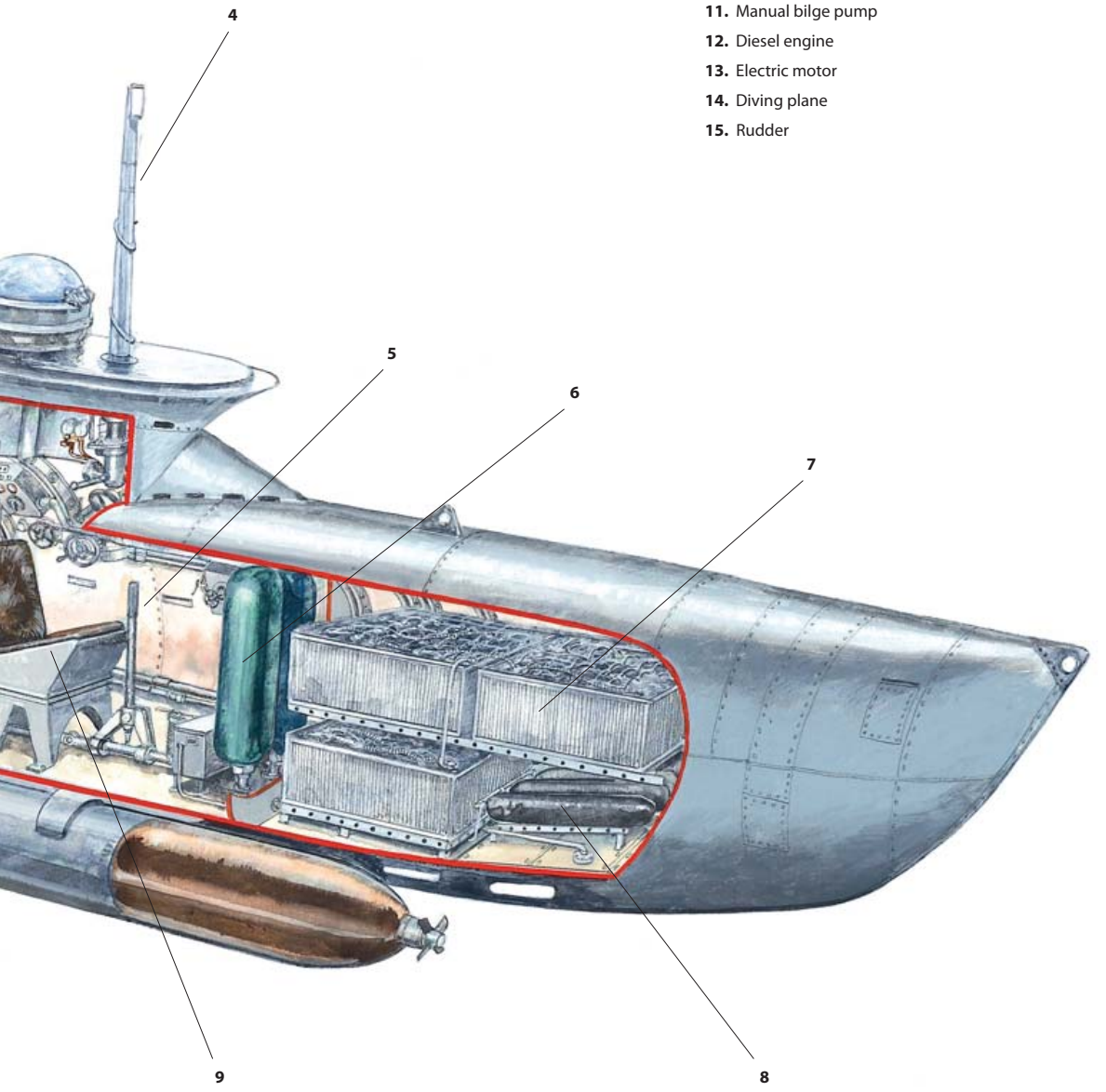
KEY

1. Engineer's seat
2. Air intake mast
3. Magnetic compass mast
4. Periscope
5. Steering lever
6. Oxygen bottles
7. Batteries
8. Compressed air bottles
9. Commander's seat
10. Fuel oil consumption tank
11. Manual bilge pump
12. Diesel engine
13. Electric motor
14. Diving plane
15. Rudder



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Seeteufel

Seeteufel was an attempt to overcome the difficulties inherent in launching and recovering human torpedoes and small submarines. A submarine equipped with tracks, the arrangement provided for autonomous unloading and water entry and exit. It also expanded the number of possible launching and recovery areas and potentially allowed a shorter water transit time to the operational area.

Designed and built in four months, the prototype had a crew of two, displaced 35 tons and was 14.2m long. An 80hp gasoline engine could drive the tracks or propeller, giving the vessel a speed of 10km/h on land and 10kt on the surface. Submerged, it could cruise at 8kt using a 25hp electric motor.

Unlike the manned torpedoes and other midget submarines, which were armed with a variant of the G7e torpedo with fewer batteries and a reduced range and speed, the Seeteufel possessed a flooding device that enabled it to employ the standard G7e. Alternatively, it could carry four mines. It was also equipped with either a machine-gun or flamethrower for use on land.

While performance in the water was satisfactory, on land it was underpowered and had an excessive ground pressure due to the narrow tracks. Additional prototypes with a more powerful engine and wider tracks were planned as a prelude to series production. However, the Oberkommando der Marine (OKM) canceled the project in 1944 as part of a plan to rationalize midget submarine development.

Manta

Resembling a catamaran, Manta was intended to travel at high speeds on the surface – 50kt – and attack submerged. Two side keels each contained a Schwertwal II propulsion unit and two aircraft tires. The tires were to facilitate entry and exit from the water, but the vessel's 50-ton weight would have made this impractical. Four tubes for torpedoes or mines could be closed with flaps while traveling.

Type XXVII F/F2

A small, torpedo-shaped, one-man midget submarine powered by a Walther turbine. Its underslung torpedo caused high drag, resulting in limited range. It was one of the projects canceled by the OKM in 1944.

Schwertwal I and II

Schwertwal I was a highly maneuverable, very fast vessel – 30kt submerged – powered by an 800hp Walther turbine. Designed to destroy enemy submarines, it was to be equipped with an acoustic detection system and had a gyroscopic orientation system. Schwertwal II was even more streamlined and was designed to be able to travel 100nm at 32kt.

Delphin I and II

Designed for high-speed submerged approaches, Delphin had an excellent, teardrop-shaped hull fabricated using economical automobile body construction techniques and an acrylic dome similar to that on the Neger and Marder, and was able to dive dynamically. It was originally designed to be expendable, similar to the Linse explosive boat, having an explosive charge in the bow. A towed mine was later proposed as an option. Three Delphin Is were produced. A larger version using a closed-cycle Seehund propulsion unit, the Delphin II, was also proposed.

Analysis and Conclusion

Germany's use of manned torpedoes and midget submarines produced few

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results, particularly in light of the number constructed. Unlike Italy and Japan, which embraced their adoption and employment as an integrated part of a coherent doctrine, they were largely rejected by Germany. When the deteriorating war situation spurred the adoption of these types of vessel, the design process was necessarily rushed and further handicapped by the need to use the limited materials that were still available in quantity. The resulting vessels bore all the hallmarks of improvisation. While succeeding types represented incremental improvements, they still contained many flaws that limited their effectiveness.

The crews, some of whom had no naval background, were enthusiastic but received only brief training – at least in the beginning – prior to undertaking operations. Trained U-boat crewmen were not permitted to serve as operators, the navy preferring to retain them for use on the more advanced conventional U-boats being developed. Unsurprisingly, while not intended as one-way missions, operations resulted in high losses both of men and vessels.

Only with Seehund was Germany able to field a relatively advanced midget submarine and well-trained crews to operate it effectively. While highly successful, the Seehunds entered service too late to make a real difference.

The conceptual designs developed near the end of the war incorporated features intended to address the known operational limitations of the earlier vessels. However, while some were technologically advanced, most were impractical and merely diverted resources from other, more useful projects.

JAPAN

History and Doctrine

The wartime exploits of Japanese midget submarines are fairly well known, at least in their role at Pearl Harbor. However, what is not common knowledge is that these boats were not designed for harbor attack, but for a role in the climactic clash between the American and Japanese battle fleets. The driving force behind the development of the midget submarine was Captain Kishimoto Kaneharu, who was also instrumental in the development of the Type 93 oxygen-propelled torpedo. From the very start, the midget submarine program was carried out under the strictest secrecy. Just like he had done with the Type 93 torpedo, Kishimoto guided his team through a number of major technological hurdles to come up with a deployable weapon that offered great promise.

The original premise behind the midget was to develop a fast and cheap weapon that could play a part during the titanic clash between the American and Japanese battle fleets that the Japanese expected would decide the course of the war in the Pacific. This decisive battle was the center of Japanese naval doctrine and included a number of aspects to reduce the size of the larger American battleship force before the actual clash of dreadnoughts took place. The attrition of the American battle fleet was primarily the mission of the Japanese night combat forces, principally using torpedoes from destroyers and heavy cruisers. However, midget submarines were also envisioned as playing a role. Before or during the gunnery duel between fleets, large, fast submarine tenders, each carrying 12 midget submarines, would deploy their charges in the path of the oncoming American fleet. With their high speed

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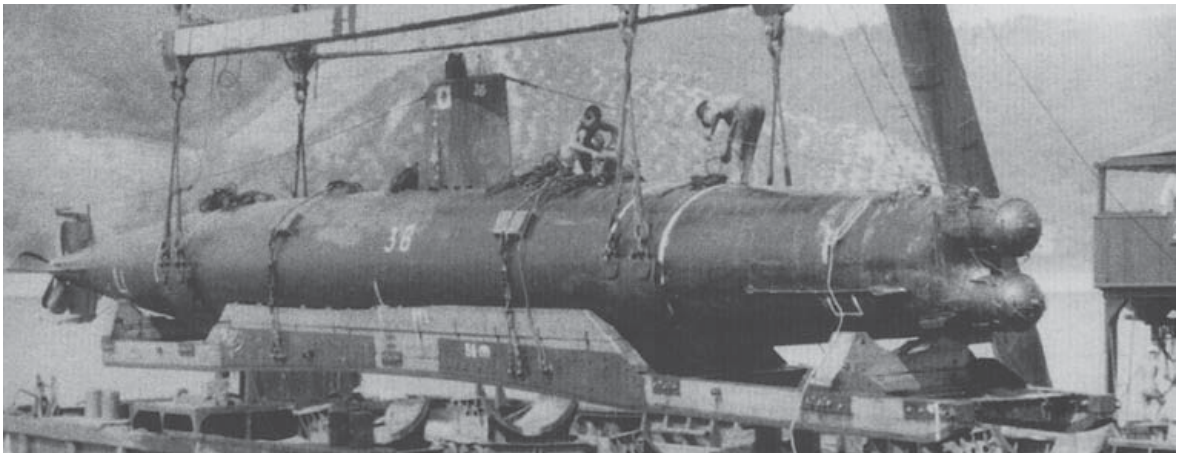

Type A midget submarine Number 36 on August 17, 1943. By this time in the war, surviving Type A boats were being employed in training roles. (*Ships of the World* magazine)

and each carrying two Type 72 torpedoes, the midgets were expected to cause great damage to the enemy. In reality, this concept was never tested in any prewar exercises, and in any event, the decisive surface battle between the Imperial Japanese Navy and the US Navy never occurred.

The decisive battle design criteria called for the midgets to possess high speed, short range, the ability to carry two torpedoes, and sufficient habitability to support the crew so that it could be recovered after the battle. It is important to note that the midget submarine was not designed as a suicide weapon. However, once the boats were used for penetration into enemy harbors, all concerned recognized that the crew's prospects for survival were low.

Work on an unmanned midget submarine started in 1932. Once the project was approved, work began on a prototype that was completed and tested in August 1933. The first manned trials were conducted in October and continued through December 1934. Despite the promise showed in the tests by the two prototypes, further progress on the program was halted until two additional midgets were ordered in the summer of 1939 for additional trials. These were launched in April and June 1940. The new set of trials included launching from the stern ramp of seaplane tender *Chiyoda*, which was accomplished successfully in a variety of sea conditions and at differing

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THE GERMAN PROTOTYPE VESSELS

The top profile shows the Seeteufel. This ungainly-looking vessel reflected the lack of conveniently located port facilities and the resulting interest in vehicles capable of launching themselves into the water. The second profile shows the Manta, another design for a vehicle capable of being easily launched. The wheeled Manta was something of a hybrid vessel, with the features of both a hydrofoil boat for high surface-speed and a submarine. The third profile illustrates the Delphin I. Its good hydrodynamic shape reflected another design imperative: high speed. The towed mine proposed as an alternate armament would not have created as much drag as an external torpedo. Testing ended after one of the prototypes accidentally rammed an accompanying surface escort. The bottom profile is of the Schwertwal I. As with Delphin I, speed was a priority and Schwertwal's design omitted a drag-inducing periscope in favor of an acoustic detection system. Forward-mounted hydroplanes with fixed stabilizing fins in the tail unit were used to enhance maneuverability while submerged. In addition to the two "K-Butt" hydrogen peroxide-fueled torpedoes, a rocket-propelled torpedo and the same type of towed mine proposed for Delphin were also considered as options. The British recovered the prototype from a lake where it had been sunk by the Germans, but later scrapped it.

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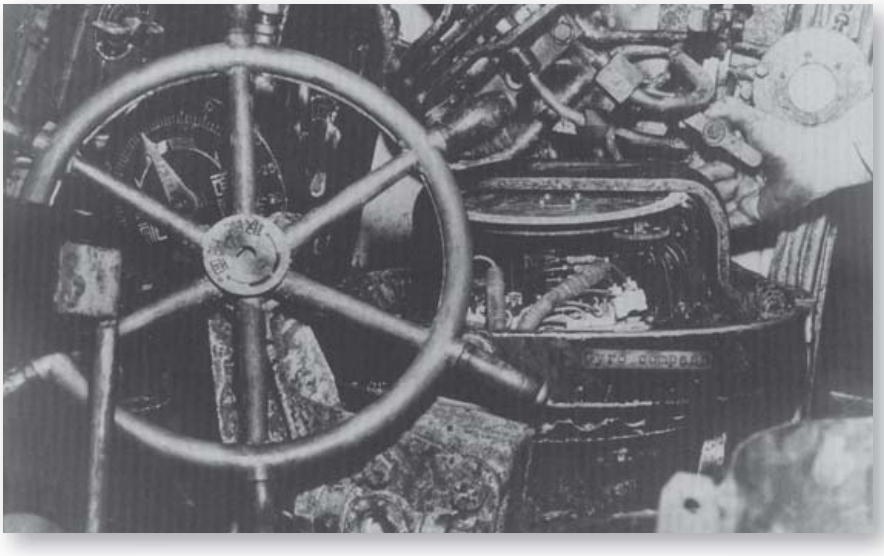
Chiyoda in 1938. In July 1941, she was converted into a midget-submarine carrier able to carry 12 boats, which could be launched in 17 minutes by a system of rails moving down a ramp through two hinged doors in the stern. *Chiyoda's* commanding officer, Captain Harada Kaku, was a leading proponent of the midget submarine program. (Yamato Museum)

speeds. The midget was officially accepted for service on November 15, 1940 and given the name *Ko-Hyoteki* (Target A) as a cover name for its real purpose. Training began at once for two groups of submarines totaling 35 officers and enlisted men that were completed in August 1941.

Midget Submarine Development

The first production midgets were known as Target A Type A. The single hull was built of welded 8mm steel plates and divided into three sections. The forward section contained the two torpedo tubes mounted one over the other, the middle section contained the battery rooms and the control room and small conning tower, and the aft section contained the electric engine.

The forward section was built around the two 450mm torpedo tubes that fired the Type 97 torpedo. The improved Type 98 that was used after the Pearl Harbor attack replaced this. Both carried a 350kg warhead and possessed a range of 5,500m and 3,200m respectively. The tubes were free-flooding as a weight-saving measure, but this basic design meant that there was no way to vent the tubes internally when they were fired, thus exposing the boat's position with a stream of bubbles.



Interior view of a Type A midget submarine showing the helm and gyrocompass. The crew was extremely cramped, but this was considered bearable since the endurance of the midget was measured in hours. (*Ships of the World* magazine)

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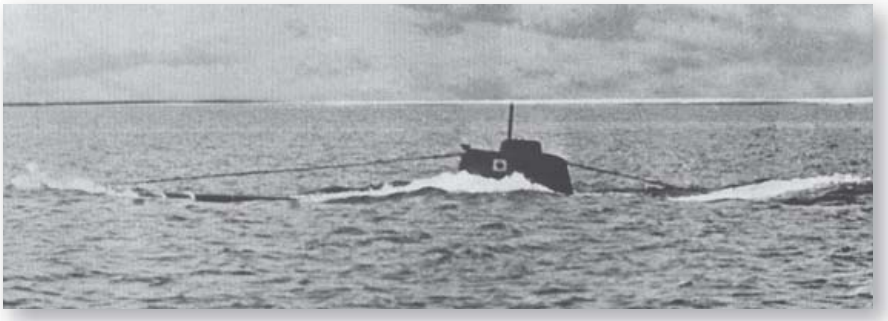
The center section contained the forward and aft battery room with a total of 192 cells, each having two 2V cells. This was also where the trim tanks were located. Between the battery rooms was the control room that contained the essentials for navigation including the depth control gear, the gyrocompass, helm, torpedo firing control, a small radio, and the periscope. Above the control room was the conning tower that had the only access into and out of the submarine by way of a single hatch. The rear section contained the 600hp electric motor.

Type A/B/C Specifications		
	Type A/Type A Kai 1	**Type B/C**
Displacement	46 tons submerged	50 tons submerged
Dimensions		
Length	23.9m	24.9m
Height	3.1m	3.1m
Beam	1.85m	1.88m
Top speed	24kt submerged	18.5kt submerged
Range	84nm at 6kt	same, but surface range
	15.8nm at 9kt	300–350nm at 6kt
Machinery	one electric motor driving one shaft with two counter-rotating screws	same, but with a diesel engine
Diving depth	100m	100m
Crew	two	three

Learning from the lessons of the operation at Pearl Harbor, the Japanese made improvements to some Type A boats. These were designated Type A *Kai* 1. The modifications were fairly minor, but were intended to improve the harbor penetration capabilities of the midgets. They were provided with net-cutters on the bow and in front of the sail, a bow device shaped like a sled to allow the submarine to climb over obstacles, a propeller guard to reduce the possibility of getting the screws entangled in nets or cables, and an improved gyrocompass to aid navigation. In all, some 47 Type A boats were produced.

The Type B attempted to address the range issue. These were fitted with a 40hp diesel engine to recharge the batteries while the submarine was on the surface. To manage this more complex propulsion system, a third crewmen was added. The armament was unaltered. The additional weight of the diesel engine reduced the maximum submerged speed to 18.5 knots, but the ability to charge the batteries while surfaced extended the range to 300–350 nautical miles. The last Type A was completed in May 1943 as the Type B prototype. Subsequently, four other Type A boats were converted to Type B. Series



This is a Type C midget under way in 1945. When properly trimmed to run on the surface, almost the entire conning tower was above the surface, making it fairly easy to spot by alert defenses. The larger conning tower makes it identifiable as a Type C. (*Ships of the World* magazine)

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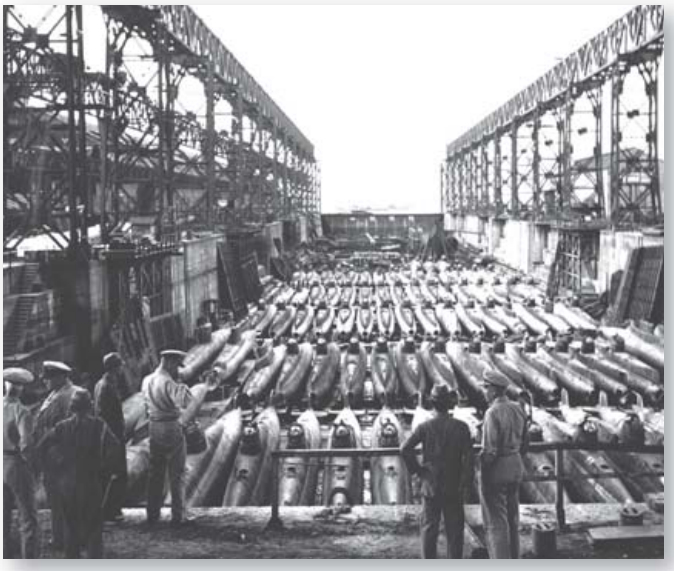

A dry dock filled with Type D midget submarines found at Kure Navy Yard when the Americans occupied the base in October 1945. Over 100 Type D boats were in various stages of completion at the base. (NARA)

production of this design was known as Type C, with the first being completed in January 1944 and the last in August 1944. At least 16 were produced, but the number could have been as high as 47, with several being converted into training boats.

The Type D was not ready for service until January 1945. These boats were given a larger diesel engine that increased surface speed and cut the time needed to recharge the batteries from the previously excessive 18 hours to just eight. The boat was not much bigger (86ft long and 60 tons in weight) than the Type C, but carried a crew of five. The larger crew reduced the space available for the electric motor and a shortage of batteries reduced underwater power to 500hp, which translated into a maximum submerged speed of 15kt. The surface range was now 1,000nm at 8kt.

The boat was designed to be mass-produced and was engineered to break down into five prefabricated sections. The Japanese believed these were ideally suited for homeland defense, so production plans called for 540 by September 1945 and 180 each month after. Production shortages translated into only 115 completed by the end of the war, with another 496 in various stages of construction.

Midget Submarine Wartime Service

The Hawaiian Operation

The first and best-known operation by Japanese midget submarines was as part of the attack on Pearl Harbor in December 1941. In August 1941, the midget submariners began thinking about the use of their weapons for attacking enemy ships in harbor. To deliver the short-ranged midget subs to their targets, they advocated the use of fleet submarines as mother subs. In support of this idea, target studies were done on several potential enemy bases including Pearl Harbor. The Naval General Staff was also approached with the concept. Later in September, midget submarines from *Chiyoda* conducted a series of night exercises to prove the viability of the concept.

F

THE JAPANESE MIDGET SUBMARINES

The top profile shows the Target A Type A midget submarine. This was the type that conducted the Pearl Harbor attack. The design features a streamlined hull, a small conning tower, two torpedoes in uncapped tubes, and, for the Pearl Harbor attack, a pointed "8"-shaped net cutter. The second profile is of a Target A Type A *Kai* 1, which shows the modifications made after Pearl Harbor. These include the provision of a different style of net cutter and, on the leading edge of the conning tower and on the bow, a device to overcome obstacles. It also had a guard around the screw to prevent entanglements. It was these boats that attacked Sydney and Diego Suarez in early 1942. The third profile is of a Target A Type C. The only discernable major external difference is the slightly greater length and the larger conning tower. Finally, the bottom profile shows a Target A Type D boat, which featured a new-design streamlined hull and conning tower.

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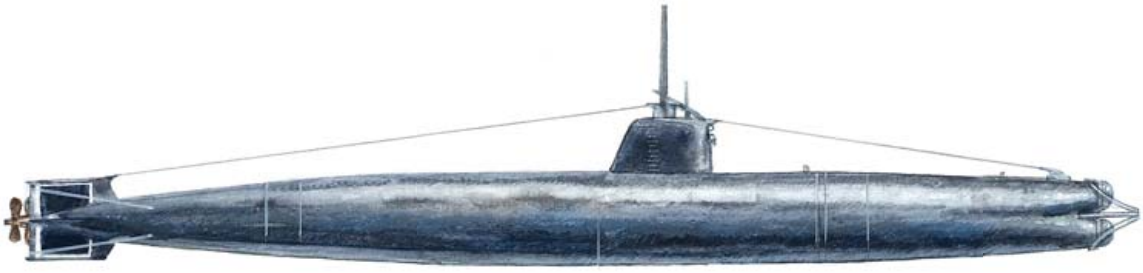

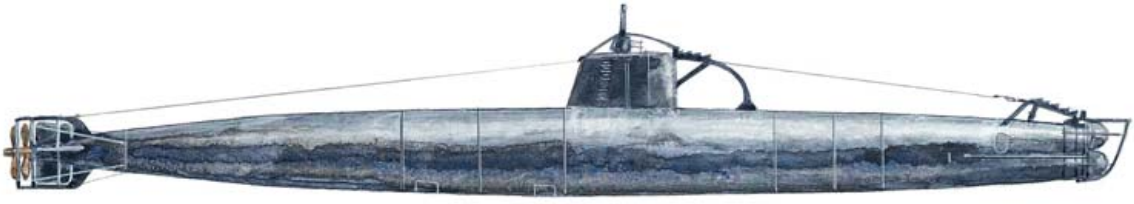

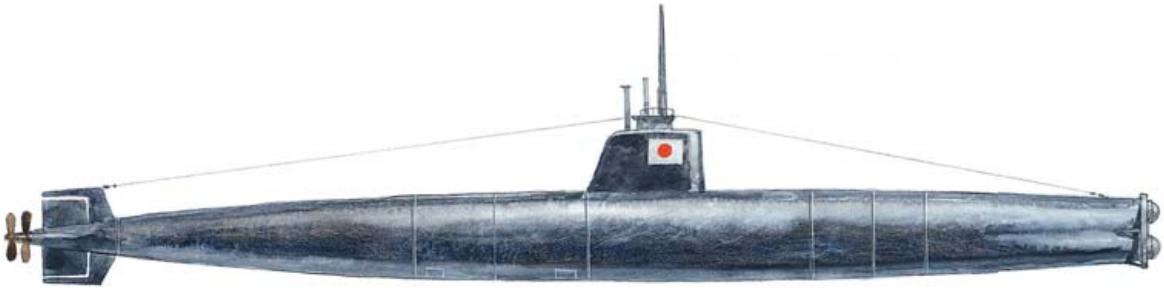

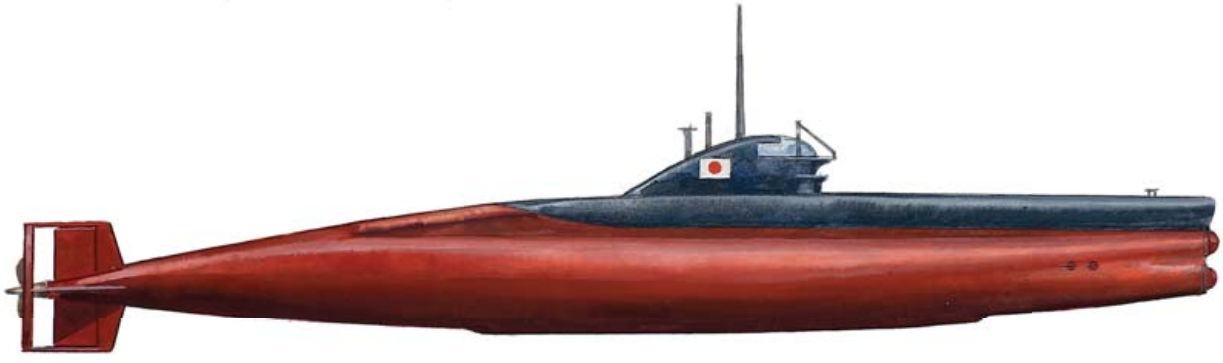

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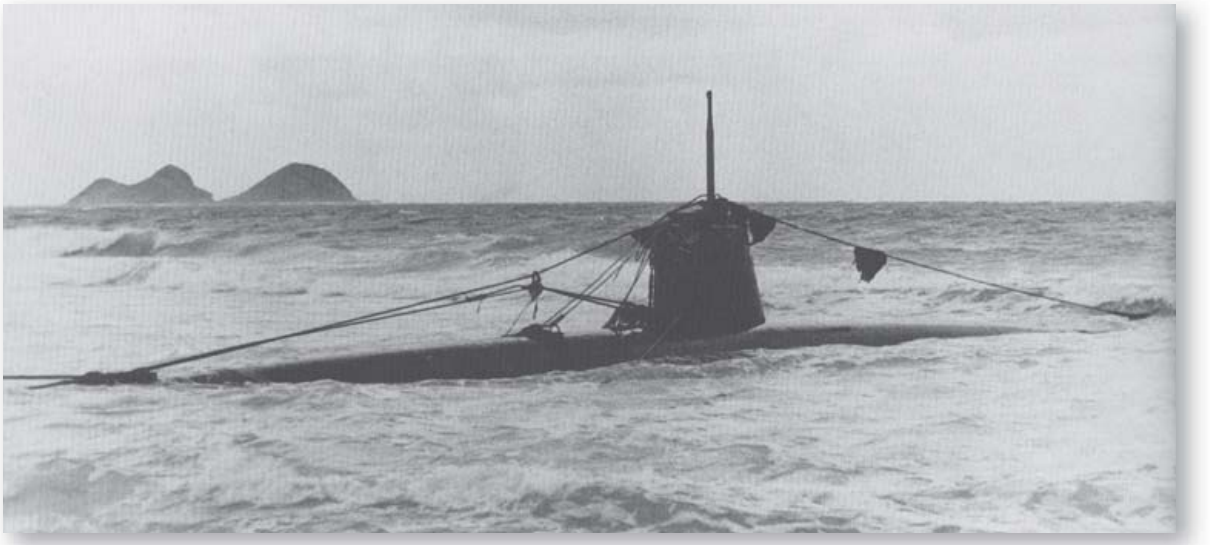

This is the Pearl Harbor Type A from *I-24*. The midget suffered from a malfunctioning gyrocompass and was unable to enter the harbor channel. Following a series of attacks, the submarine washed up on the east coast of Oahu, as shown here. One of the crewmen, Ensign Sakamaki Kazuo, staggered ashore and was captured, becoming the first prisoner of war of the Pacific War. (*Ships of the World* magazine)

On October 4, the captain of *Chiyoda* attended a Combined Fleet planning conference that was going over the pending Pearl Harbor operation. He advocated the use of midget submarines to complement the air raid. Combined Fleet commander Admiral Yamamoto Isoroku was initially not keen on the idea, but the midget-submariner persisted and made an emotional plea. By the time of the next conference on October 11–13, Yamamoto had approved the inclusion of midget subs in the operation. Yamamoto had acceded to the submariner's pleas in spite of the vehement objections of the aviators who had planned the operation. The basis for their objections was the possibility that the midget submarines would be discovered before reaching their attack positions and thus jeopardize the surprise of the entire operation. In fact, this is exactly what happened, when one of the submarines was discovered in the harbor channel over four hours before the commencement of the air attack. Luckily for the Japanese, the Americans did not grasp the importance of this discovery and failed to use the potential warning time. Yamamoto's inclusion of the midget subs can only be seen as foolhardy, since they imperiled the success of the entire operation while offering little additional prospect for inflicting damage. The possible loss of surprise was not worth the gamble of including them in the operation.

Once the decision had been made, work commenced to prepare five midget subs for the operation. The steering system was improved at the cost of 25 batteries from the forward battery room. This decreased the maximum speed to 16kt. Five I-16 (Type C1) fleet boats were converted to carry the midgets and a phone system installed between the mother sub and midget. This work was completed by November 10. After operations and intelligence briefings from an officer who had been on Oahu to scout Pearl Harbor's defenses in early November, the five submarines (*I-16*, *I-18*, *I-20*, *I-22* and *I-24*) departed Kure on November 19 to conduct a direct transit to Pearl Harbor.

The transit was uneventful, and the five submarines arrived off the mouth of Pearl Harbor in time to launch their midgets early on the morning of December 7. The midgets were launched from a distance of 5.3 to 13 miles from the harbor entrance, but the operation, dubbed *Divine Turtle Operation Number 1* by the Japanese, quickly went sour. At 0342hrs, minesweeper

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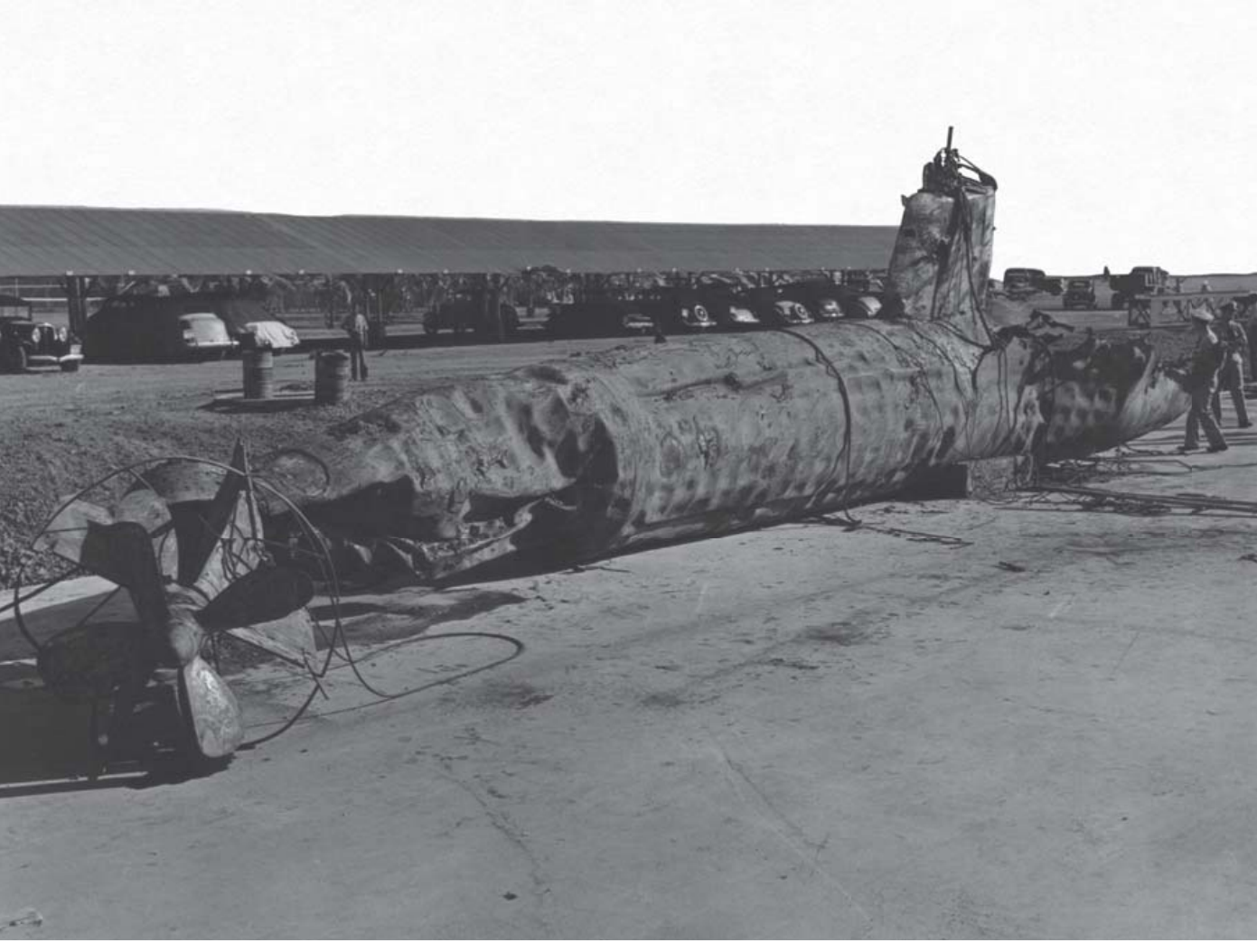

This is the midget submarine sunk by destroyer *Monaghan* inside the harbor and recovered two weeks later. (Naval History and Heritage Command)

Condor spotted a submarine conning tower in the restricted area south of the harbor approaches. Within minutes, the destroyer *Ward* responded to the report but found nothing. Contact was regained at 0630hrs by the stores ship *Antares* and a patrolling PBY Catalina flying boat that dropped smoke markers on the contact. When *Ward* returned at 0645hrs, she established contact and opened fire with her 4-inch main guns. The second shot hit the submarine on the base of the conning tower and *Ward* followed up with depth charges. At 0651hrs, *Ward* reported "WE HAVE ATTACKED FIRED UPON AND DROPPED DEPTH CHARGES UPON SUBMARINE OPERATING IN DEFENSE SEA AREA." Despite these first shots of the Pacific War between Japan and the United States, the Americans failed to take advantage of the warning. In 2002, this submarine was found 5 miles off the harbor entrance, with the 4in shell still discernable.

The fate of the midget from *I-24* can be determined with certainty. The submarine reached the mouth of the harbor by 0700hrs, but an hour later ran aground on a reef. At 0817hrs, the destroyer *Helms* spotted the submarine and engaged it with gunfire. The midget was able to apply full power and get off the reef. However, the crew was overcome by chlorine gas from the batteries, and after a series of American attacks, the submarine washed up on Waimanalo Beach near Bellow's Field on the eastern coast of Oahu. The crew set the scuttling charge, but it did not explode. The submarine was discovered

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This Pearl Harbor midget was not discovered until 1960 and this photo was taken on July 28, 1960 when the submarine was recovered. The two sailors in the foreground give a proper scale to understand how small Japanese midget submarines were.

with both torpedoes still aboard, and one of the crewmen was captured. This submarine is now on display at the National Museum of the Pacific War in Fredericksburg, Texas.

Another midget was depth-charged and sunk in the Keehi Lagoon just off the entrance to Pearl Harbor. This submarine was discovered in 1960 with both of its torpedoes still aboard. It was returned to Japan and is now displayed at Eta Jima.

One of the midgets did succeed in getting into the harbor. At 0836hrs, crewmen aboard the seaplane tender *Curtiss* spotted a submarine several hundred yards off her starboard quarter. Several other ships also spotted the midget and several opened fire, with *Curtiss* firing first. Destroyer *Monaghan* charged toward the contact with the intent to ram the midget. The midget fired one of its torpedoes at *Curtiss* that missed. The submarine then broached, and was hit by a 5in shell from the tender. The second torpedo was fired at *Monaghan*, but missed by some 20–30 yards. The destroyer preceded to ram and then depth-charge the midget. This submarine was raised off the harbor floor two weeks later.

The actions of the last midget still remain a mystery. Just after 1000hrs, the light cruiser *St Louis* was clearing the harbor when a midget fired two torpedoes 2,000yd off the cruiser's starboard beam. One of the torpedoes

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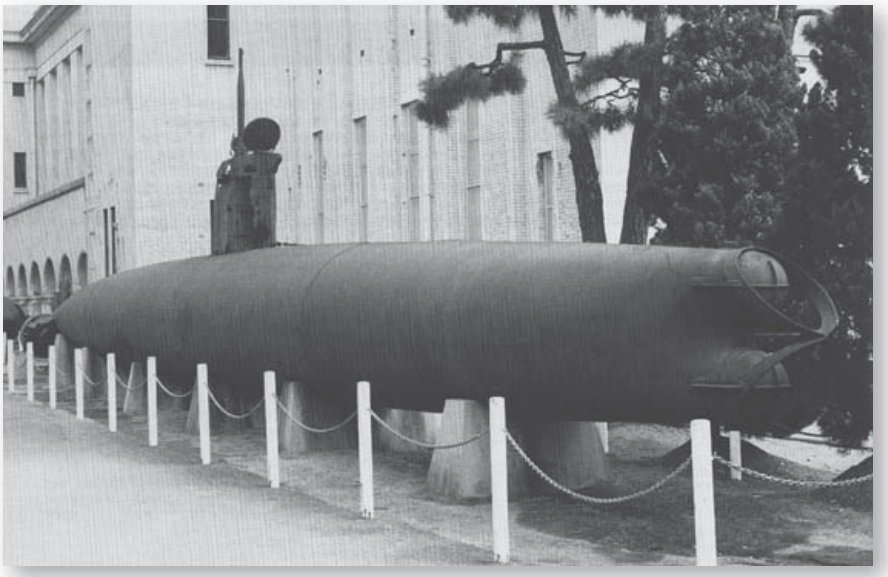

This is the Type A midget submarine, which took part in the Pearl Harbor operation and was not discovered until 1960. The submarine currently resides at Eta Jima where this photo was taken. (*Ships of the World* magazine)

struck a coral reef only 200yd from the ship and exploded. The cruiser responded with 5in gunfire that was followed by the destroyer *Blue* delivering a depth-charge attack after gaining sonar contact. Recent theories suggesting attacks within the harbor by this midget cannot be substantiated. Overall, the Japanese use of midget submarines at Pearl Harbor was a failure.

The Sydney Operation

In spite of the failure of the Pearl Harbor operation, the Japanese remained convinced that midgets still had utility in attacking enemy harbors. Planning for Operation *Divine Turtle Number 2* began in mid-December 1941. In April, *Chiyoda* arrived at Truk with a load of Type A *Kai* 1 boats. On May 17, *I-22, I-24* and *I-27* departed Truk en route to Sydney, each with a midget aboard. *I-21* and *I-29* were also included in the operation and each carried an E14Y seaplane for preattack reconnaissance.

On May 23, the floatplane from *I-29* conducted a reconnaissance flight over Sydney. The pilot reported the presence of two Warspite-class battleships, one in the harbor and a second in dry dock. Based on this information, the commander of the Sixth Fleet (the Imperial Navy's submarine force) ordered an attack the following day. A final preattack reconnaissance was performed by *I-21's* seaplane on May 29 that confirmed the presence of a battleship. The commander of the submarine group ordered the attack to occur on May 31. The three mother submarines arrived off Sydney on May 30.

The following day, the three midgets were launched between 1721hrs and 1758hrs at distances between 6 and 7.2 miles off the harbor. Inside the harbor were not two battleships, but two heavy cruisers, USS *Chicago* and HMAS *Canberra,* and a number of smaller ships. Booms protected the harbor, but otherwise the Australians were not expecting an attack in spite of many warnings including communications intercepts, reports of submarines off Sydney, and the sighting of the Japanese floatplane.

The first midget, from *I-27*, became entangled in the antitorpedo boom deployed across the harbor entrance just after 2000hrs. After several Australian attacks, the midget crew used its scuttling charge to destroy the boat. Both crewmen were killed.

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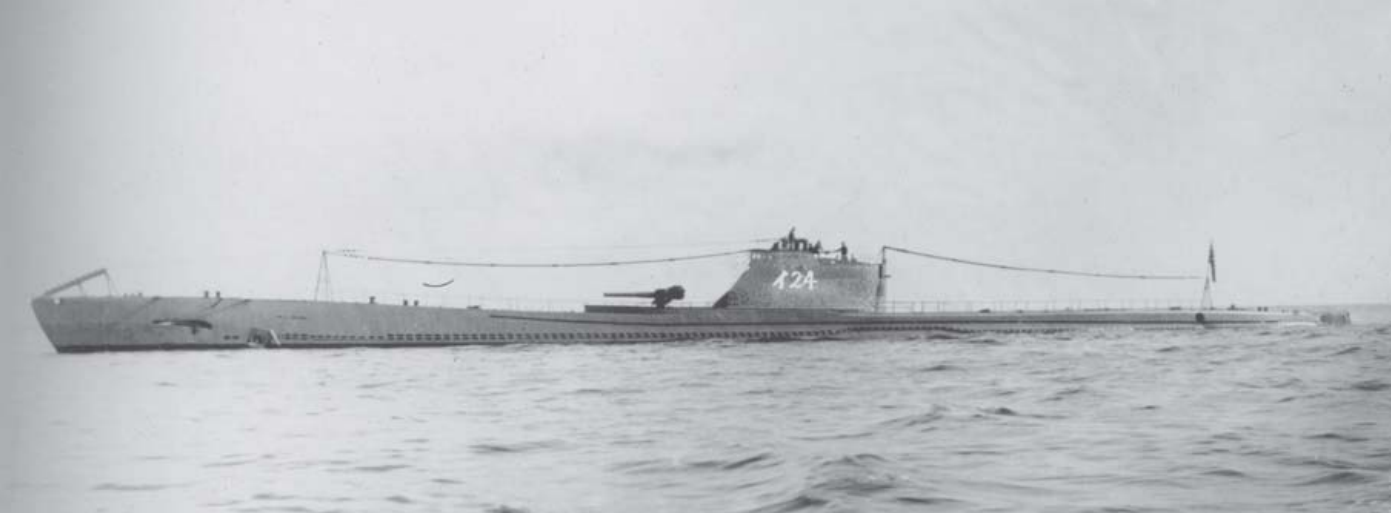

I-24 in 1941. The five Type C1 units were the preferred platforms for bringing midget submarines to their target area. *I-24* took part in the Pearl Harbor and Sydney attacks and one operation off Guadalcanal before being sunk off Kiska Island in June 1943. (Yamato Museum)

The midget from *I-24* entered the harbor early during 2200–2300hrs by following a ferry through the boom. Upon entering the harbor, the submarine was spotted several times and was engaged by 20mm guns from *Chicago* and probably by other ships as well. At 0029hrs on June 1, the midget launched the first of its torpedoes, followed by a second one 30 minutes later. These were aimed at *Chicago*, but both missed. The first passed under Dutch submarine *K-IX* and hit the adjacent accommodation ship HMAS *Kuttabul*. The old ferry sank with the loss of 21 men, and the submarine was damaged beyond repair. The second torpedo failed to arm and ran aground on a nearby island. The midget subsequently made its way out of the harbor and was not discovered until 2006. It has yet to be raised.

The final midget from *I-22* did not enter the harbor until almost 2300hrs. After surviving an attack, it waited several hours to continue. It was subsequently sighted and engaged during 0300–0400hrs. Later, at 0500hrs, the midget was detected again and this time attacked by depth charges from three harbor patrol boats. At this point, the crew committed suicide. The midget was found later that day with both its torpedoes still on board. This midget and the one from *I-24* were both raised and used to make a composite Type A *Kai* 1, which is on display at the Australian War Memorial in Canberra.

Six Type A midget submarines were deployed to Kiska Island following its capture by the Japanese. Of these, three survived until the Japanese evacuated the island in July 1943. Those are pictured here in an August 1943 view showing the effect of Japanese efforts to destroy them. (*Ships of the World* magazine)

The Attack on Diego Suarez

The least known of the Japanese midget submarine harbor penetrations was their most successful operation. This was launched almost simultaneously with the attack on Sydney by four submarines, with *I-10* acting as flagship and reconnaissance boat and Pearl Harbor veterans *I-16, I-18* and *I-20* each carrying a Type A *Kai* 1 midget submarine. The group sailed from Penang, Malaya on April 30, 1942, and headed for the southeastern coast of Africa. The floatplane from *I-10* made several flights over major naval bases in South Africa beginning on May 20, but found nothing worthy of attack.

Late on May 29, the same aircraft flew over Diego Suarez in northern Madagascar in search of suitable targets.

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Earlier, on May 5, the British had launched an attack to capture Madagascar from the Vichy French. Therefore several warships remained in the harbor and the Japanese floatplane reported the presence of a Queen Elizabeth-class battleship and a cruiser. In fact, Royal Sovereign-class battleship *Ramillies* was present, and the Japanese commander decided to launch an attack with his three midget subs the following night.

Of the three mother submarines, only *I-16* and *I-20* launched their midgets. Of these, only one penetrated the harbor. This was the midget from *I-20*, which reached a firing a position at 2025hrs on 30 May. The crew launched one torpedo against *Ramillies* that hit forward and created a 30ft by 30ft hole. Severe flooding resulted, but the battleship's crew was able to control it. The damage was extensive enough to put *Ramillies* out of commission for almost a year. The midget attempted to use its second torpedo to finish off the battleship, but instead it hit the tanker *British Loyalty*. The tanker sank quickly, but was later raised and placed back in service. After launching its attacks, the midget headed out of the harbor to the prearranged rendezvous with *I-20*. The two crewmen were forced to scuttle their submarine (unsuccessfully) and headed on foot to the recovery area. After covering 48 miles, they were turned in by natives and killed by Royal Marines on June 2. The fate of the midget from *I-16* remains unknown. After being unable to participate in the attack, the midget aboard *I-18* was jettisoned on June 9.

Midget Submarines in the Solomons

The last offensive use of midget submarines was in the Solomons off the island of Guadalcanal. *Chiyoda* carried 11 Type A submarines from Kure to Truk in late September 1942, and in early October a midget submarine base was established on the northern tip of Guadalcanal. On October 14, *Chiyoda* delivered eight midgets to Shortland Harbor off southern Bougainville Island. Three submarines, *I-16, I-20* and *I-24*, arrived at Shortland to load midgets. On November 7, *I-20* deployed her midget to attack American shipping off Lunga anchorage. The attack was successful and scored a torpedo hit on transport *Majaba*, which was beached to prevent it from sinking. The crew then headed to the midget base off northern Guadalcanal where it arrived that afternoon, making this the first midget submarine crew to survive an attack.

The only other successful attack off Guadalcanal was mounted on November 28, when the midget from *I-16* torpedoed cargo ship *Alchiba*. The single torpedo hit caused severe fires from drums of gasoline in the ship's hold. Although a midget from *I-24* torpedoed the ship again on December 7, *Alchiba* was salvaged and served for the duration of the war. In total, eight midget submarines were lost in operations off Guadalcanal.

Midget Submarines on the Defensive

For the remainder of the war, Japanese midget submarines were restricted to operations from various shore bases. In this role of providing local defense, they proved spectacularly unsuccessful. *Chiyoda* carried six Type A boats to Kiska Island in the Aleutians on July 5, 1942.

This is the only surviving Type C midget in the world. This view shows it in May 1945 on Guam. The boat is currently in the possession of the National Park Service and remains on the island. There is no record of it having been in combat. (*Ships of the World* magazine)

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A Type C midget pictured on May 27, 1945 under attack by American PV-1 patrol bombers in the Davao Gulf. The midget was apparently already abandoned. Note the attempt to camouflage the conning tower. (*Ships of the World* magazine)

These did not see action and were destroyed before the Japanese evacuated the island in July 1943. Five midgets were sent to the major Japanese base of Rabaul in the South Pacific in late 1943, but only one arrived safely and it saw no action. Five Type C boats were sent to the Marianas, but only three arrived safely. The Japanese scuttled these when the islands were invaded in mid-1944. One was discovered on Guam and restored where it remains today. It is the only Type C in existence.

A similar story played out in the Philippines. Eight Type C boats were deployed in August and October 1944 and operated principally out of a base on Cebu Island. There was an abundance of targets in the Philippines after the American invasion in October, and the midget submarines made extravagant claims of ships sunk and damaged. The only claim that can be confirmed was on February 21, 1945 when one torpedo hit and damaged an American destroyer. All the Type C midgets were lost.

Six midget submarines were deployed to Chuchi-jima in the Bonin Islands in 1944, but conducted no combat sorties. The final actions for the midgets were during the battle for Okinawa. Nine Type C boats arrived there in late August and as many as eight Type D boats between January and March 1945. Despite the abundance of targets against the American invasion force, there was only one possible success when an American destroyer was hit and sunk on March 26 off the island of Kerama Retto. American sources claim it was mined, but it could have been the final victim of the Imperial Navy's midget submarine force. All of the Okinawa-based midgets were lost.

Analysis and Conclusion

The Japanese midget submarines were the most sophisticated of any midgets of World War II. However, their design was far from perfect. Aside from the problem of a short range already mentioned, Japanese midgets had continuing issues with keeping proper depth and tended to broach unexpectedly.

G

ATTACK ON HMS *RAMILLIES*

This scene depicts the moment that HMS *Ramillies* was struck by a Japanese midget-sub torpedo in Diego Suarez harbor on May 30, 1942. The torpedo struck the ship on its port side, causing a large hole and extensive flooding. The battleship was patched up to allow her to steam to Durban, South Africa for repairs on June 3 under her own power. The ship was out of the war for nearly a year. With its second torpedo, the midget submarine sank tanker *British Loyalty*, which backed up in front of the battleship, thus saving it from a second possible torpedo hit. The crew of this midget submarine, Lieutenant Akeida Saburo and Petty Officer Takamoto Masumi, conducted a daring and skilful attack that included successfully navigating up the long and narrow channel into the harbor. Akeida was a very experienced midget-submarine operator who had been with the secret Target A program from the start. This illustrates one of the principal problems with the entire Japanese midget-submarine program – the boats were challenging to operate and required highly trained crewmen to be successful.

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Another batch of Type D midget submarines found at Nagasaki at the end of the war in various stages of completion. The Japanese planned to deploy hundreds of these improved boats against the expected American invasion of the homeland. (NARA)

This was especially apparent after a torpedo was fired, since the reserve trim tanks could not fill fast enough to compensate for this loss of weight. In the hands of an experienced crew, the midgets could achieve results. In the hands of lesser-trained men, as was evidenced later in the war, Japanese midget submarines were ineffective.

As has been described, the Imperial Navy's midget submarines were designed for a role that they were never used for during the war. Instead, they were initially used for offensive penetrations of enemy harbors. While spectacular in this role, they were also largely unsuccessful. For all the investment in the midget submarine program, the heavy losses suffered by the midgets and their crews, and the diversion of many fleet submarines away from other operations, the damage inflicted on the Allies was meager.

The loss of surprise after the first series of harbor penetration attacks and the general lack of effectiveness of the Imperial Navy's submarine force meant that the campaign of offensive midget operations was abandoned and they were used as defensive weapons on Japanese-held islands for the remainder of the war. In this role, they proved even more unsuccessful. Alert American defenses and vulnerability to American aircraft were successful in keeping the midget submarine threat in check.

The Imperial Navy's large midget-submarine force of 1945 could have played a significant role in any final battle against an American invasion of Japan, but this promise was never tested. The Type D boat possessed a much

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larger range and could have presented a real threat to the invasion force if deployed in large numbers. Some of the later Type D boats had their torpedo tubes replaced by a large explosive charge for ramming enemy targets. This further blurred the already hazy line between Japanese midget submarine operations and suicide attacks. In the final analysis, Japanese midget submarine operations were just another component of the overall disappointing results gained by the Imperial Navy's submarine force.

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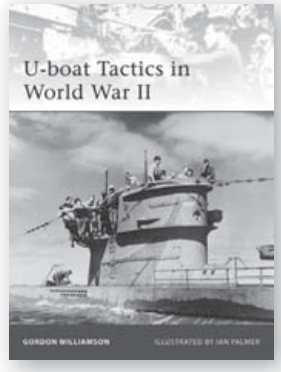

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